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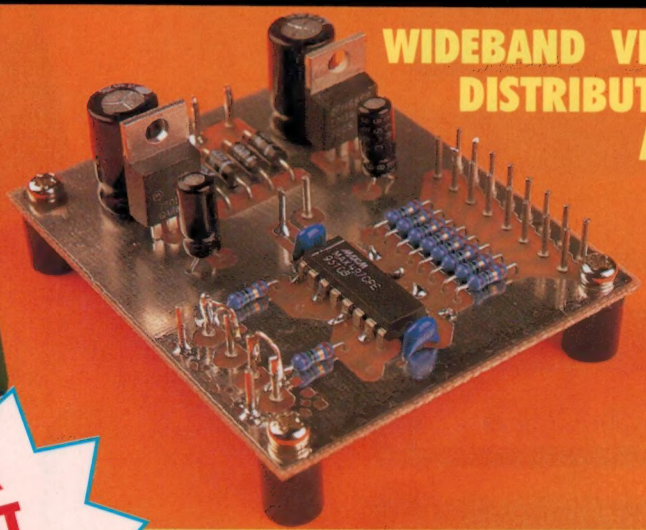

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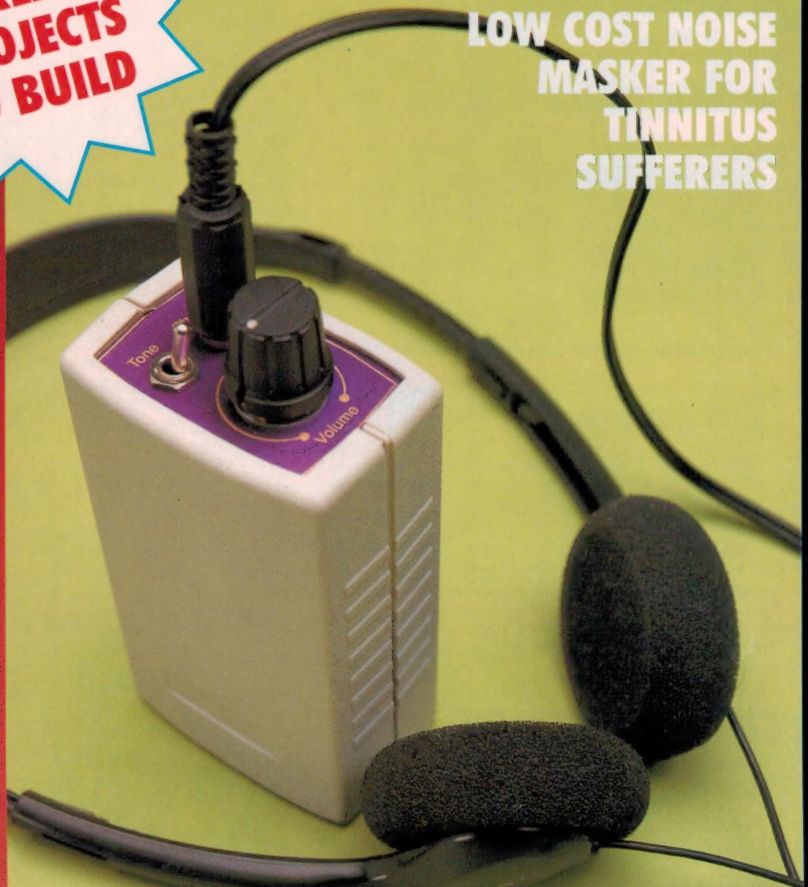

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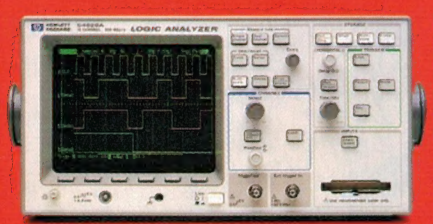

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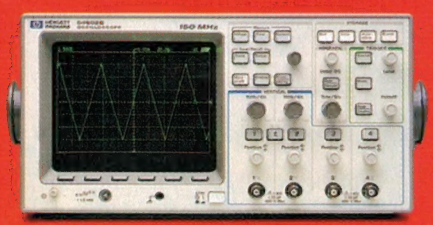

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Electronics

AUSTRALIA with Professional Electronics & ETI

Volume 59, No.12
December 1997

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Inside an ISP's dungeon...

What are you actually connecting to, when your modem calls up the ISP of your choice to let you 'surf the Web'? Most ISPs are quite coy about revealing just what equipment and resources they have, but Tom Moffat was able to persuade one to show us inside his 'dungeon'. See page 22...

Digital camera update

Digital still camera technology continues to race ahead, with new and ever more impressive models (like this new Olympus D-500L SLR) appearing every few weeks. Barrie Smith discusses the developments that have taken place this year, in his article starting on page 14...

On the cover

If you're into building projects, one of the four shown should appeal. The Line Carrier Link will control your appliances remotely via the mains wiring, while if you suffer from tinnitus our Noise Masker should let you find some peace. Otherwise you can flash your Christmas lights, or run multiple monitors from your VCR...

World of Electronics

Projects and Technical

Columns and Comments

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Professional Electronics

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phone (02) 9353 9992; fax (02) 9353 0967.
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ELECTRONICS AUSTRALIA is published by Federal Publishing Company, a division of Eastern Suburbs Newspapers Partnership, which is owned by
General Newspapers Pty Ltd.
A.C.N.000 117 322,
Double Bay Newspapers Pty Ltd.
A.C.N.000 237 598, and
Brehmer Fairfax Pty Ltd.
A.C.N.008 629 767,
180 Bourke Road, Alexandria, NSW 2015.

Printed by Macquarie Print, 51 - 59 Wheelers Lane, Dubbo 2830. Phone (02) 68 843 444.
Distributed by Newsagents Direct Distribution Pty Ltd, 150 Bourke Rd, Alexandria 2015; phone (02) 9353 9911.
ISSN 1328-6218
* Recommended & maximum Australian retail price.
Member of the Audit Bureau of Circulations

LETTERS TO THE EDITOR

'Better value...'

I would like to wish you all at EA a belated happy 75th anniversary, from the UK. Due to a spell working in the USA and then a return to Britain, and moving house etc., I had let my subscription expire a while ago, but renewed it just in time to receive the August anniversary issue.

Having read (and written for) a selection of journals in recent years, both British and American, I still find that *Electronics Australia* is by far the best hobby electronics magazine currently available. So many other once-fine journals here and in America seem to have been reduced to nothing more than advertisements, new product news and dubious 'reviews' for the latest black box from the Far East. The cover prices have gone up at a fantastic rate, and the quantity and quality of the content has dropped dramatically.

Even with overseas postage to England, I feel that *EA* remains much better value for money. Best wishes for your continued success.

Paul Coxwell
Eccless-on-Sea,
Norwich, England.

EMC/CE labelling

Just a quick note to let you know that my 18-month-old daughter is a happier person, because she knows she can read her ABC picture book and she won't cause, or be subject to, any interference.

Yes, it has a CE logo on the back, with the publisher's info (England — Campbell Books). God help us!

Paul McVitty
Aspendale Gardens, Vic.

Other stations?

I have been a reader of your magazine since about May 1965, just before the change to the current name, and, although I have had no formal training in electronics and some of the articles are beyond my understanding, I enjoy reading much of each issue. The first item to be read is always 'The Serviceman' in which I can often relate to the problem.

Having had an interest in 'public address' and tape-recording since the mid-1950s with many recordings of major events, I have experienced many of the problems described.

Reading your article in the 75th Anniversary Supplement, I note your statement 'In 1923 the first radio broadcasting stations begin operations in Australia: 2FC and 2SB... The following year 3AR and 3LO officially open in Melbourne, and 6WF in Perth.' What about Adelaide, Brisbane & Hobart?

On 11/6/84 the University of Adelaide radio station 5UV devoted the day's programs to celebrating the 60 years of radio since station 5DN opened on that day in 1924. Little doubt other cities had similiar dates. Could I suggest an update of your historical records to include such events.

Eric H. Wilkinson
Westbourne Park, SA.

Memories...

Thank you for a fascinating review of progress in electronics over the last 75 years (*EA*, August 97). Having to spend the weekend at home with the flu has given me the chance to catch up on some overdue reading.

When I look back, I realise that I began subscribing to *Radio & Hobbies* 45 years ago, in 1952 when I was 12. I built my first *R&H* designed mains-powered radio set in 1954. A lot of the developments in your anniversary article occurred since then and reading of them brings back many memories.

For example, in relation to computers I recall, as a trainee engineer, being shown proudly the new IBM 7090 at a defence establishment in SA.

It was a marvel in its time. It used a magnetic core memory occupying about a cubic foot (apart from all its read and write circuitry, which filled a whole cabinet) and was strategically located in the middle cabinet of a horseshoe of others in a large, air-conditioned room.

In the middle was a control console the size of a large office desk. Programs (in Fortran) were laboriously typed onto punched cards, each of which could hold 80 bytes, and were then read mechanically into the machine.

The engineer who showed us around explained that computers could not get

faster by more than a few percent until they found ways of making them smaller. The propagation time for signals from one end of the array of cabinets to the other, a distance of many feet, was the main limiting factor.

The core memory (RAM), being the most frequently addressed part of the machine, had to be in the middle so that signals in and out had an average distance to travel. This was a key factor in the race to miniaturize computing equipment — something which your article appears not to have mentioned. How integrated circuits have changed all that!

Best wishes for the next 75 years of the magazine, too. It is still the most interesting, informative, and worthwhile read on the market.

Kevin R. May
Watsonia, Vic.

Delighted winner

You can not believe how happy I was to win *EA*'s recent Baygen Freeplay Radio competition. I had been interested in getting hold of one of these radios from when I first heard of them over a year ago. When they did make it to our shores, they were a little expensive for me so I kept putting off purchasing one. I am so grateful to *Electronics Australia* and Dick Smith Electronics for the opportunity to win one. I think that the radios themselves are a great invention, and the humanitarian sentiment of the designer is also commendable. Such a simple, yet very effective idea to provide cheap access to information.

Let me say again how pleased I was to win the competition. The radio arrived today, and ironically moments after the courier dropped it off we had a power blackout so it was immediately pressed into use. We couldn't boil water for a cuppa, but we could listen to the radio...

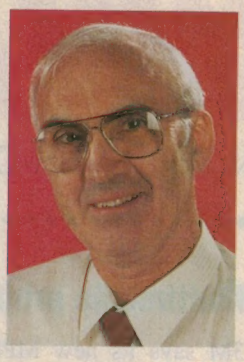
Might I also take this opportunity to mention that I would be interested in seeing an article on small valve amplifiers, which was mentioned as a possibility at the end of the article on the single-valve receiver.

Thanks again, and congratulations on a magazine with such a warm friendly ethos that provides interesting articles on a broad range of topics.

Andrew Mason
Toowoomba, Qld. ❖

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Plenty of holiday reading, but some sad news as well

Well, here we are again, with this issue the last for 1997. It has been a busy year, but hopefully with the holiday season not far away, it won't be long before we can all pause to relax and catch our breath — to prepare for 1998!

We've packed quite a lot into this issue, to make sure you have plenty of interesting reading for the start of the wind-down period. Louis Challis has written the second part of his report on a visit to the Philips Research Labs in Eindhoven, and talks specifically about products like the company's new multi-standard DVD player, its Velo 1 handheld PC and its new super-capacity manganese alkaline cells. Barrie Smith also provides a report on what's been happening in the digital camera market during the year, and gives a preview of some of the new models.

One of the feature articles I can really recommend is Tom Moffat's story on what's actually inside a typical Internet Service Provider (ISP). We've had quite a few requests for a story on these lines, but it turned out to be almost impossible to get any local ISPs to provide us with any information. Luckily Tom was able to step into the breach, and managed to talk his local ISP owner into co-operating. The result makes very interesting reading...

We haven't forgotten construction projects, of course. Graham Cattley has designed a great little audio masking device for people who suffer from tinnitus; it's very compact, and by all accounts *much* less expensive than the commercial models. Rob Evans describes how to build and set up his low-cost power line carrier transmitter and receiver, for remotely controlling appliances either manually or using your computer, and there's also a wideband video/pulse distribution amplifier, from yours truly. We even have a simple circuit for a Christmas light flasher, from an appropriate but perhaps surprising contributor!

There are quite a few reviews of interesting new products, too. You'll find pieces on the new Olympus P-150E digital colour printer, the Korg NS5R MIDI music synthesiser module, the Zoom 56Kx 56kb/s faxmodem and the Baintech 500W/12 sinewave power inverter.

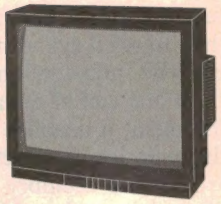
One way and another, then, we trust you find plenty to interest and inform you in this last issue for 1997. Needless to say it comes to you with best wishes for a relaxing and enjoyable Christmas and New Year season, from all of us on the *EA* production team.

We do end up 1997 on one sad note, however, because as you'll read on page 88, our long-time contributor Arthur Cushen passed away recently — just after sending us this month's Shortwave Listening column. As mentioned in our October issue, Arthur had contributed his shortwave notes to us for over 45 years (since October 1952). His passing is not only a sad event for us all, but clearly marks the end of another era.

Jim Rowe

WHAT'S NEW

IN THE EVER-CHANGING WORLD OF ELECTRONICS



Multimedia projector delivers 650-lumen SVGA

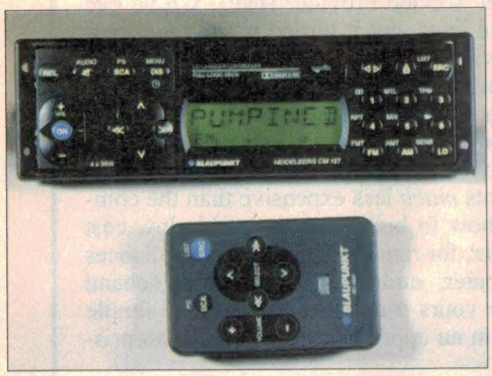
3M says its new MP8640 Multimedia Projector, based on the successful MP8630, is even better suited for business presentations by virtue of its higher light output. Designed to achieve a successful balance between high-end boardroom performance and projector mobility, the MP8640 is highly versatile. It has a fully recessed, integrated power zoom lens as well as built-in stereo speakers and audio outputs for hooking up external speakers.

Increased on-screen brightness to 650 ANSI lumens, true SVGA 800 x 600 pixel resolution and exceptional colour reproduction are claimed to ensure that the MP8640 offers leading image quality. A universal power supply is fitted, while two computer input channels integrate with either IBM or Apple Macintosh models. The two video inputs are NTSC/PAL/SECAM and S-VHS compatible.

A compact VirtualMouse remote control with power zoom, power focus and presentation tools mean the presenter can easily access the MP8640 from almost anywhere in a room.

For further information circle 145 on the reader service card or contact 3M customer service on 1800 023 423.

Car radio with a memory



The new Blaupunkt Heidelberg CM147 car stereo receiver has a novel memory feature that means a driver need never again miss a favourite program or a scheduled traffic report. It also offers advanced features such as CD changer controls, four powerful 35W speaker outputs, high voltage low impedance four-channel preamp out and auxiliary input and a fully detachable electronic faceplate.

The Tuner Timer feature works like a clock radio. It will automatically switch sources and tune to any desired AM or FM radio station at a specified time, even if it is already on another station, playing a cassette, a CD or even turned off. The Tuner Timer is easily set and, at the touch of a button, can be de-activated if not required.

All the major functions of the state-of the-art unit can be controlled via a cordless remote control, a feature first offered by Blaupunkt in 1985 and now refined down to credit card size.

The Heidelberg CM147 has an RRP of $549. For more information circle 142 on the reader service card or ring the Blaupunkt Customer Service Hotline on 1800 629 414.

Well-priced digital cellphone

The new Ericsson GA 628 digital mobile phone is claimed to be packed with powerful features, including up to six hours talk time and 100 hours standby time. It is compact, at only 130mm long, weighs just 160g with the Slim battery, and is especially durable.

A claimed feature of the GA 628 is its choice of 15 brightly coloured, interchangeable panels, to allow consumers to match it with their precise taste and mood. However these accessories are not included in the kit.

Consumers can also select their own personalised ring signal with a choice of four ring tones and seven ring melodies. Depending on the mood, consumers can choose melodies ranging from Rossini's William Tell Overture to Bach's Toccata.

With the Ericsson Mobile Office Accessory, the GA 628 performs both fax and data transfer at a speed of 9600b/s. It also features the ability to store up to 50 names and numbers in its phone book (additional numbers can be stored on the SIM card).

Other features of the GA 628 include Calling Line Identification (CLI), which displays the caller's number, Alternate Line Service (ALS) which allows subscribers to have two different phone numbers, and Call Hold/Call Wait capability for handling two calls at once.

For further information circle 149 on the reader service card or contact Ericsson's customer service number on 1300 650 050.

GPS plotters feature colour LCDs

Furuno claims to be the first marine electronics manufacturer to introduce a new generation of GPS Plotters and GPS Plotters/Sounders with colour LCD displays. Until now, the luxury of colour was the domain of the professional fisherman or boat owners who had a vessel of sufficient size to accommodate the large CRT displays of colour GPS Plotters and Sounders.

Because the new GP1610C and GP1610CF are so compact, Furuno says they're now a proposition for the small trailerboat owner. The display units are only 221 x 226 x 104mm (W x H x D), while the antenna unit is just 67mm high by 62mm wide.

Another feature of these GPS receivers is that, unlike most competitive brands, the receiver board which processes data from the satellites is not in the antenna. This means the very sensitive receiver board is not mounted outside the vessel and exposed to the harsh marine weather conditions.

The 5.6" colour LCD screen is claimed to suffer very little degradation in sunlight. In plotter mode, the user can select a variety of colours and marks to record events to suit his own individual preference.

In sounder mode, the GP1600CF display is very high resolution and the sounder operates on 300 watt output, which gives extremely good definition of fish and bottom and makes the unit ideal for serious leisure fishing.

The GP1610C GPS Plotter retails for about $2700 and the GP1610CF GPS Plotter/Sounder for about $3150. For further information circle 147 on the reader service card or contact Taylor Marine on 1800 620 809.

New Icom radio is computer driven

The world of radio communications can now be explored via your PC, with the help of a small black box from Icom: the IC-PCR1000, which turns your PC into a full-function radio communications receiver.

A simple click of your mouse and a radio receiver is displayed on your PC screen. You manipulate the radio control display with your mouse and tune into your favorite local FM music station, shortwave overseas broadcasts, amateur broadcasts, emergency service, shipping, aviation or TV sound.

The PCR1000 comes complete with a telescopic aerial, connects to your PC serial port and is compatible with most computer models — even laptops. It brings three receiver interfaces to your PC screen — a communications receiver; a four component display; and a radio screen with presets and frequency readouts.

The IC-PCR1000 covers from 0.5 - 1300MHz with all-mode receiver capability. You can even add a satellite weather fax. It groups memory channels into 'banks' of 50, and these can be stored on your hard disk or on a floppy. This set-up is supported by a bank and memory name function which stores frequency, attenuator, filter setting details and more.

For further information circle 150 on the reader service card or contact Icom (Australia), 290 - 294 Albert St, Brunswick 3056.

VCRs offer one-key programming

Programming a video cassette recorder can be a frustrating experience. With this in mind, Mitsubishi Electric has developed Easy One-Key Programming. By pressing a single button on the remote control, you're able to program the VCR quickly and easily even when G-Code is not available (for example when you don't have a TV guide).

The new range of Mitsubishi VCRs also includes G-Code and Easy Time Addition, in addition to Easy One-Key Programming. They also feature a new Excellent Picture function, which includes a variety of special settings said to make it easy to optimise picture quality with any tape — whether for recording or playback. Top end model HS761V, for example, incorporates a Tape Optimizer that analyses the quality of the cassette, displays a bar graph on screen and then adjusts the brightness and contrast accordingly, whether the tape is new or old.

Another feature of the Excellent Picture function is the Rental Mode, which adjusts the picture depending on the type of video being played. For example, in sport mode the picture is softened, in animation mode the colour is enhanced and brightened, and in movie mode the picture is made 'warmer'.

There are five models in the new range of Mitsubishi Electric VCRs, from the top-value model HS720V (RRP $373) to the top of the range Stereo Hi Fi model HS761V (RRP $880). For further information circle 143 on the reader service card or contact Mitsubishi Electric Australia, 348 Victoria Road, Rydalmere 2116.

Toshiba projector delivers true XGA

Toshiba has announced the Australian release of the TLP511 — an extremely bright multi-media projector featuring true XGA (1024 x 768) resolution.

Claimed as the first projector in the world to combine XGA data resolution, video and a built-in document camera, the TLP511 Media Star is a lightweight unit (7.9kg) producing a minimum brightness of 600 ANSI lumens. This makes it bright enough to be clearly seen in a well-lit room and compact enough to fit under an airplane seat. A built in carry-handle allows for convenient transportation.

The novel fold-out document camera projects all documents, transparencies, and three dimensional (including moving) objects placed on top of the projector body.

The TLP511 is compatible with the newest Pentium and Power PC's, NTSC and PAL data and video, and also handles SXGA (1280 x 1024) data projection in a compressed format.

For further information circle 148 on the reader service card or contact Audio Visual Australia, 25 Jersey Road, Bayswater 3153.

New bus for custom AV systems

Australian custom AV installation specialist Leisuretech Electronics has announced the release of a completely new multi-room system called A-Bus (Pat Pending), claimed to be capable of completely changing the way multi-room systems are designed.

A-Bus eliminates brings a new simplicity to system design by requiring only one low cost cable from the source components to any remote room. The same cable carries infrared data transmission, status indication and system power muting.

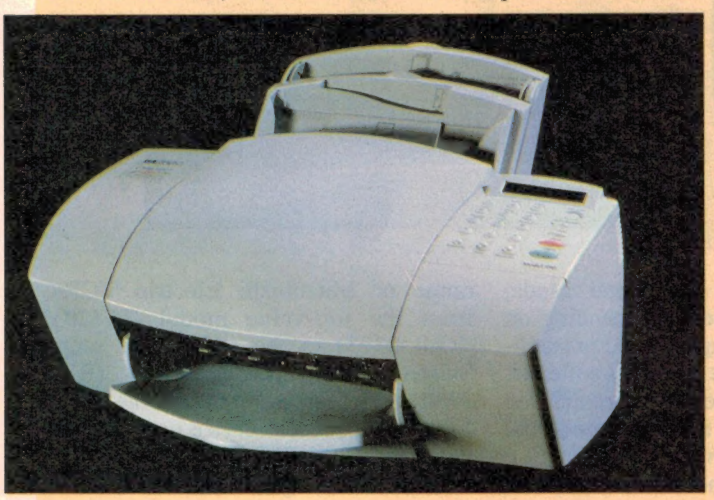
The A-Bus system also eliminates the need for expensive impedance matching devices and attenuators. And because A-Bus receives signal from the main system's tape output, the volume control of the amplifier in the main room no longer controls the other speakers in the system. Each room simply requires a power module which will fit into an electrical switch housing (recessed or surface).

A-Bus is powered by a low voltage power pack, which will power up to three rooms. A larger high current power supply will soon be available to power up to eight rooms.

Manufactured in Australia, A-Bus was designed by Len Andrews, whose products have received the *Sound & Image* magazine Custom Installation Product of the year award for the two years it has been awarded, and also the 1996/7 Technical Innovation award. For further information circle 146 on the reader service card or contact LeisureTech Electronics, 7/620 Botany Road, Alexandria 2015.

New HP OfficeJet 'All-in-One' product

Hewlett-Packard, a leader in the colour inkjet printer and scanner markets, has announced a new product in its HP OfficeJet all-in-one range for small business and home office applications. The new HP OfficeJet 590 integrates the functions of a colour inkjet printer, scanner, copier and fax machine, and delivers them in a friendly, space-saving design carrying an RRP of only $799.



The HP OfficeJet 590 software integrates seamlessly with a home office's personal computer, and is claimed to make everything from creating quality business documents to PC-faxing more efficient and reliable. A setup 'wizard' guides users through the initial setp and configuration using plain English.

The scanner built into the 590 provides up to 600dpi enhanced 8-bit scanning, while the printer delivers black text at speeds of up to five pages per minute, and colour documents at up to 2ppm.

The HP OfficeJet 590 comes with bundled software including Corel Print and Photo House Select 2.0, Adobe Acrobat and Calendar Creator, and Caere OmniPage Limited Edition OCR software.

For further information circle 151 on the reader service card or contact HP Australia's toll-free customer service line on 131 347.

Wide Screen Projection TVs

Pioneer's new wide screen projection TV monitors, the 50" SD-T50W1 and the 43" SD-T43W1, are said to bring home TV viewing closer to the cinema experience than ever before. Differing only in screen size and both boasting a 16:9 aspect ratio, the two monitors provide what is described as 'outstanding picture quality'.

The SD-T50W1 and SD-T43W1 offer five screen viewing modes: Natural Wide, Cinema Wide, Zoom, Full and 4:3. In the Natural Wide mode, you can fill the big screen with a naturally expanded picture from any 4:3 source such as an ordinary TV program. The technology used ensures that the picture is least affected at the centre and more expanded toward the edges, to give a natural looking picture wherever you sit. Cinema Wide lets you enjoy films in the original dynamic proportions on a wide screen. Finally, the full auto Zoom function automatically chooses the most suitable mode for a video programme.

An advanced computer reference system developed by Pioneer gives precise convergence of projected red, green, and blue beams, resulting in highly accurate convergence for lifelike colours. The 9-Point Digital Convergence System lets you adjust convergence from the remote control, at the centre and at eight points on the periphery. In addition, the Three-Line Y/C Separation uses a digital comb filter to separate luminance (Y) and chrominance (C) signals through digital processing. The claimed result is a superb picture with pure colours and crisp edges.

A lenticular-grooved black screen allows panoramic viewing angles of 140° horizontally and 50° vertically.

Both monitors come with full multi-system capability, giving the ability to display virtually all standard broadcast systems in the world.

The Pioneer SD-T50W1 and SD-T43W1 have RRPs of $5999 and $4999 respectively. For further information, circle 140 on the reader service card or call Pioneer on 1800 060 852.

Second Generation Digital Video Cameras

Panasonic has released its second generation of digital video (DV) cameras, with two compact models claimed as the first single-CCD image sensor cameras launched by the company. The DV format 8-bit digital compression recording system provides image and sound quality previously unattainable in a consumer video camera.

The two new models are very similar in features but the higher priced NV-DS5 has a 10cm (3.8") LCD screen. The LCD screen is hinged and rotates freely over a 270° range. It folds neatly away when not being used. The two cameras are otherwise identical.

To make optimum use of the high resolution potential that the DV format offers, the two cameras incorporate a 1/3" CCD image sensor featuring a full 680,000 pixels. The bright F/1.4 lens allows shooting under minimum low-light conditions. The cameras also have a long-play mode which allows users to record up to 90 minutes of footage on a 60 minute tape.

To compliment the high quality pictures, the cameras provide digital sound of 16-bit two-channel stereo (CD level sound quality) or 12-bit four-channel stereo (two channels for original sound and two for audio dubbing).

Both models have a slide-up colour viewfinder which can be tilted to a 90° angle. The high resolution 13mm (1/2") viewfinder has a resolution of 166,000 pixels to show maximum detail.

Both cameras come with an output terminal box which enables the camera to be connected to a VCR, TV or computer. Digital video footage can be transferred to the computer via either an RS-232C port or a 'Firewire' cable.

The Panasonic NV-DS1 and NV-DS5 digital video cameras are available from leading electrical retailers for an RRP of $3499 and $4599 respectively. For further information circle 141 on the reader service card or contact Panasonic's Customer Care Centre on 132 600.

New CD changers offer high quality

The latest in Kenwood's line of compact disc players are the DP-R4090 and DP-R3090, both five-disc rotary CD changers which deliver high quality sound in a design that is efficient and convenient to use.

With the five-disc rotary system, you can change four discs while playing one. Even while listening to a CD, you can change up to four of the other loaded discs so that the music never has to stop. With the 32-track programmable memory, you can also program the play order of up to 32 tracks from any of the discs loaded in the CD changer, thus enabling you to play hours of music customised to your preferences.

Both players have a fluorescent display with four time indicators, CD time edit, 20 track music calendar, delete random play, track and program repeat, and audible track search.

Equally important, each is compatible with CCRS one-touch CD recording. With CCRS, an inbuilt computer detects peaks on the CD and then sets the optimum recording level on the cassette deck before recording starts automatically. The DP-R4090 comes complete with a remote control while the DP-R3090 is system remote controllable.

The players use a dual single-bit D/A (digital-to-analog) converter with third-order noise shaping and eight-times over sampling, for high quality reproduction. Both models are covered by a 24 month parts and labour warranty.

The DP-R4090 (RRP $449) and the DP-R3090 (RRP $359) are available at selected Kenwood dealers. For further information circle 144 on the reader service card or contact Kenwood Electronics Australia. ❖

A SECOND LOOK AT PHILIPS EINDHOVEN

Here's the second part of Louis Challis's report on his recent visit to the Philips research laboratories at Eindhoven in the Netherlands. In it he discusses some of the Company's new leading-edge products, including the DVD 930 multi-standard DVD player, the CD3600 CD-RW compact disc recording drive, the Velo 1 handheld PC and the impressive new PowerLife manganese alkaline batteries.

In the September 1997 issue of *EA*, I wrote about some aspects of Philips' development of MPEG-2 DVD players. My primary focus was the differences between the PAL MPEG-2 and Dolby Digital (AC-3) Multichannel Audio Systems, rather than on the Philips DVD players, which are of equal interest. This time I'm proposing to briefly examine Philips' approach to the design of its DVD players, and a number of equally exciting other new developments whose performance and characteristics I was briefly able to evaluate in demonstration suites and factory areas within the Philips complex at Eindhoven.

The Philips development of DVD players initially focused on the American market, through its fully owned subsidiary Magnavox. At the initial Magnavox product release on May 1, Philips Electronics announced that it had opted for a joint DVD rental program with Polygram through which consumers would be able to rent a Magnavox DVD video player, and selected Polygram digital video discs after June 24 from US video stores. What caught my eye was the sixth title of the discs for the initial release, which was *U2 Live from Sydney*. The Magnavox DVD players are designed for NTSC format digital video discs, with the lowest priced unit selling for US$549.

Multistandard players

After examining a Magnavox DVD player and viewing selected software in a Philips demonstration suite, I was shown a prototype Philips DVD 930 Matchline Multi-Standard DVD-Video Player. Although I would have liked to have seen it operating, that was not to be. The most important difference between the Philips DVD 930 and the Magnavox DVD players (and other DVD players which I have previously reviewed) is its multi-standard capabilities.

The DVD 930 is designed to accept discs which have been formatted for either Dolby Digital (AC-3) or PCM MPEG-2 audio outputs. Even if that was the only different feature that the DVD 930 offered, it would more than likely help to clinch its purchase. However I discovered that the DVD 930 also provides superb convenience, supplemented by a truly 'user friendly' on-screen setup procedure which may well give it a true marketing edge over its many competitors.

The DVD 930 is designed to operate with a 625-line PAL 50Hz signal, as well as with a 525-line NTSC 60Hz signal. On playback it will automatically conform and

adapt to multi-standard PAL/NTSC formats as an integral automated feature.

The DVD 930 is currently top model in the Philips DVD video player range. Its DVD readout system is rugged, novel and very sensible. It uses a dual-lens single laser optical pickup system to focus on the two different layers of digital video discs. Although designed for wide screen (16:9) format, it also makes special provision for optimal playback on regular (4:3) format screens.

If you stop playing a disc before its end, with the intention of coming back to view the rest of the program at some later stage, the DVD 930 automatically remembers where you stopped, and will restart the video from that point. And if that were not enough, it will do the same for the previous four discs if you didn't have time to view *them* to the very end of the program...

In keeping with the other premium DVD players, the DVD 930 provides stable, crystal clear still pictures and step-frame capability, supplemented by a choice of slow-motion viewing at one-half, one-quarter or one-eighth normal speed. In like manner, it provides fast search capability at 2x or 8x normal speed in either forward or reverse.

If you inadvertently leave your DVD 930 set to the still picture mode and forget to switch off your TV monitor or screen, a screen saver capability automatically dims the screen to protect it after 15 minutes.

As I write this review, the first samples of the DVD 930 have already been received in Australia. In 1998, with only limited supplies of PAL format DVD discs available, I believe that the Matchline Multi-Standard DVD 930 will be one of the top selling DVD players.

A Philips/Magnavox DVD player and NTSC receiver, designed for the US market. By the time you read this, players similar to the Matchline Multi-standard DVD 930 should be available locally.

Rewritable CD drives

The next new product that I was shown in the B.U. Laser Optics Group was Philips' Fourth Generation CD3600 Series CD-ReWritable Compact Disc Drive. This product will be of potential interest to almost every commercial organisation which wishes to store copious volumes of text or graphics. That information would normally be stored on a hard-disk drive, or on a removable tape or removable hard disc drive. The major attributes of the CD3600 compact disc drives are that they simultaneously fulfil multiple roles and allow you to economically achieve the following functions:

1. Recording your own CDs with Philips or another vendors' rewritable discs;
2. Acting as a CD-ROM player, as well as a conventional CD recorder drive;
3. Reading its own discs or other CD-ROM discs, at six times the normal speed, as well as writing to rewritable discs at twice the normal speed;
4. Automatically identifying the type of media as it is loaded into the drive and providing a convenient means of recording your own audio CDs, CD-ROM discs, Video CDs and even conventional Photo CDs.

The CD3600 uses standard UDF file management software, to facilitate conventional document access via conventional drag-and-drop file handling as found in most major applications and operating systems, which include Windows 95 and Windows NT. It provides an attractive 1.3GB (gigabytes) of data storage, with the convenience of a CD size disc with a projected life of more than 30 years if stored at normal room temperatures (5 - 25°C).

To go with the CD3600 Philips has released its CD-RW 740 series of rewritable discs, which are both easily stored, and more significantly, are unaffected by magnetic fields.

To go with its new CD3600 series of CD-RW disc drives, Philips has released the 740 Series of rewritable discs.

The Philips Velo 1 handheld PC, closed and ready for transport.

Consumer CD recorders

The last product that I was shown in the B.U. Laser Optics section was a new low-cost consumer compact disc recorder with an expected selling price of under $2000, and with performance characteristics comparable to the existing Marantz CDR620. The CDR620 has been selling for more than five times that price and provides mouth-watering, studio quality performance.

The advantage of the new Philips consumer CD recorder is that it will be integrated into your existing computer, which will facilitate dumping data from a hard disk or directly from an external source with the computer providing power, interface and visual/functional monitoring and controls.

Velo 1 handheld PC

Even a large company like Philips can be seduced by the concept of an exciting new product, particularly when the product is offered to it on a platter. Philips in the USA was approached by two exceptional young engineers who had developed an exciting concept of a pocket-sized lightweight handheld personal computer. The concept was infectious, because Philips had no comparable product under development, yet it had all the peripheral equipment and other newer technological elements under development.

Some people think that Philips are conservative. On this occasion they were not the least bit conservative, and with Philips' financial backing, and more importantly, the Philips Semiconductor Division right behind them, the Velo design and development team got down to work. In less than a year, the diverse groups in the Philips organisation provided all of the elements required for an outstanding handheld PC. The product had so many outstanding features, it had no close competitors for *Byte* magazine's Innovation Award for the best product at the 1996 Fall Comdex Exhibition.

What makes Velo 1 tick? Well, it provided features that no other handheld PC offered at that time. With a 17.3cm long case and either 2MB or 4MB of DRAM, it uses Windows CE, the pocket version of Windows 95. It also incorporates Pocket Word, Pocket Excel and Pocket Internet Explorer, plus software to facilitate corporate e-mail. On top of all that it provides a database, conventional scheduling capabilities, and more intriguingly a handheld voice recorder (whose recording capacity is determined by the amount of RAM).

Dedicated sockets on the base of the Velo 1 provide a GSM connection to a matching Philips digital portable phone. There is also a high speed RS-232 serial port, for interconnecting your normal PC. The unit incorporates 4MB of EDO DRAM and 8MB of fast Page Mode ROM, together with an infra-red transceiver so that you can send or receive messages to and from other PCs and compatible devices.

The Velo 1 also incorporates a socket for a Type II PC card, and a socket for connecting a wireless modem for a global positioning system (GPS). Miniature card slots are provided for additional DRAM, flash memory and ROM software upgrades.

The Velo 1 has a miniature QWERTY keyboard and a special stylus in a dedicated socket to activate the touch screen. With an all-up weight of 353gms and a 15-hour battery life on two ordinary AA batteries or a NiMH rechargeable battery pack, the Velo 1 had no contender for the title of the most potent and flexible handheld PC.

As you may imagine, the Velo 1 sold so well in America that the factory could not even meet American market demand, let alone that of Europe or Australia. Whilst I was intrigued to learn that the intercontinental supply situation was about to change, I found that less interesting than Philips' plans for the Velo II, and subsequent derivatives.

Philips realised that with the Velo 1 they were breaking new ground, and that unless they started working on the Velo 2 and even Velo 3, they would be left behind by the 'me too look-alikes' who would rapidly move in on their territory. Their approach to this issue was to convene a committee supported by top-flight external consultants, and organise a number of workshops which included the top people from Philips Corporate Design, Philips Mobile Computing Group, external consultants from Lunar Design Inc., an interaction design group and a screen interface design team.

The team came up with a number of

A dedicated socket on the base of the Velo 1 provides a connection to a GSM portable phone, for remote data communications.

novel ideas, including the Velo Solo. The Solo will be a simple easy to use, combined handheld PC and cellular phone. Its aim will be to provide the essential functionalities required for information access and communication when on the move. Those elements are typified by e-mail, voice mail, cellular phone, personal information manager and a web browser, all in a pocket-sized package. The product would utilise a colour LCD touchscreen, an integrated pen for input, a scrolling thumbwheel for web browsing and a cellular phone positioned on the side of the case for ease of use.

If and when the Solo ever gets into production, it will be a premium personalised product which will pander to the more affluent and privileged members of our society.

The design team also came up with a second and equally intriguing Velo Duo concept. The Duo will be a full configuration, handheld PC with a large colour touchscreen. This will be supplemented by an ergonomic keyboard and a detachable cellular telephone. The Duo will be designed for the professional on the move, who craves for unified functionality and who doesn't want to be bothered by having a laptop for work, a cellular telephone for communication and a separate system to be on-line.

The Duo will provide e-mail, access to the Internet, voice mail, cellular telephonic and simultaneous voice and text transmission. It will offer all of the normal PC functions in an integrated package the same size as an electronic organiser.

The third concept they came up with was a Velo Multo. The Multo can be best described as being a state of the art, portable multimedia system. If the Multo is developed, it will provide all the normal functions of a handheld PC supplemented by digital imaging, telecommuncations and the possibility of downloading full-motion video and music. Whilst the underlying concepts of digital camera, RF links, and the ability to operate in a local area network (LAN) — even wide area networks (WAN) — may sound exciting, those concepts in an item of equipment the size of the demonstration mockup are currently 'pie in the sky'.

Whilst you will have to wait quite a while for the Velo Duo to be released, and even longer for Velo Multo, I am assured that the Velo 1, with 4MB of DRAM and 4MB of ROM is now available in Europe, and will soon reach Australia and New Zealand.

New batteries

Before I left the Philips factory, I enquired regarding their latest developments in the field of batteries. I half expected that I would be shown a range of new miniature Lithium Ion batteries, which I had heard that Philips had recently developed. That however is not what I was shown. I was a trifle surprised when I was introduced to Edmundo Klophaus, the Product Manager for Batteries, who proceeded into a dynamic sales pitch about Philips' new PowerLife manganese alkaline batteries.

Now I thought I was reasonably up-to-date with battery developments, and particularly with manganese alkaline batteries which are now the largest selling primary batteries in the world — and also available in a modified format which renders them suitable for recharging between 10 and 50 times. But Edmundo proceeded to improve my education, presenting me with a short history of battery development, starting with the work of Georges Leclanche, the renowned French engineer who developed the zinc carbon battery back in 1866.

In the 131 years following Leclanche's invention, we have seen some outstanding developments. Of these one of the most important was that of the manganese alkaline battery in 1959. Following its development, manganese alkaline batteries soon pushed the ubiquitous carbon zinc batteries into a second-order ranking. Since the beginning of the 1980s, they have assumed a position of pre-eminence in the marketplace.

Louis was also given a preview of the new Philips PowerLife manganese alkaline cells, with almost double the power capacity of existing alkalines.

Whilst manganese alkaline batteries offer major attributes of long shelf and service life, and good low and high frequency performance, they do have limitations in terms of current capacity. They have a significant internal resistance when compared with other batteries such as lithium ion, nickel metal hydride, or even the ubiquitous nickel-cadmium battery which people love to hate.

Philips' researchers discovered that they could dramatically reduce the internal resistance of a manganese alkaline battery, and thereby increase its peak current output by incorporating a chemically-expanded graphite substrate in with the synthetic manganese dioxide which is used to provide the PowerLife cell's positive electrode. The net gain from adopting this formulation is that, under heavy current demands, a PowerLife battery typically achieves a 50% increase in effective power output, and close to a doubling of the peak power capacity.

If somebody had suggested to me that a PowerLife AA cell could provide a 1 - 1.25 amps of steady and extended current output, I would have doubted the integrity of that statement. I must admit that I was even more surprised when Edmundo provided me with two torches, and a set of PowerLife batteries so that I could confirm the objectivity of his claim.

When I returned to Sydney, I put two PowerLife batteries in one torch, and two quality new manganese alkaline batteries from another manufacturer in the second torch, and turned on both torches. After the full-on exposure I had received, I wasn't really surprised to observe that the conventional manganese alkaline batteries illuminated the torch for only 37 minutes. By contrast, the PowerLife batteries were still providing effective light output a full hour after they had been switched on and were still producing useful light output 10 minutes later.

In comparative assessments where the current drain requirements are less than 0.5 amps, a PowerLife battery offers no real advantage when compared with a normal manganese alkaline cell. However when the power demands are markedly higher, and typically approaching a demand of one amp or even more, then a set of PowerLife AA batteries offers significant advantages.

The high drain operational advantages of the PowerLife cells are obvious. A less obvious advantage is the ability of a set of AA PowerLife batteries to replace a set of C cells, in a new or possibly even in an existing situation.

Last but not least, PowerLife batteries have a claimed shelf life of three years, which I acknowledge I have not yet personally confirmed. If that claim is true, then these batteries offer a set of performance attributes which will rapidly endear themselves to most of us in a wide range of different applications.

As I left Eindhoven, Rinske Stege, Philips' Assistant Press Officer, handed me a folder in which a number of other mouth-watering new products were described. Had I had more time, I would have asked her to take me to a number of other buildings in the Philips' facility. The literature she provided only whetted my appetite to learn more about a number of new products, most of which will reach the Australian and New Zealand markets late in 1997, or early next year.

After a sojourn of two full days at Eindhoven, my overall impression was that although Philips is now more than 100 years old, the organisation and its products appear to be as dynamic as ever. They are still at the forefront in their development of new technology, and are still converting good ideas into exciting new products. ❖

Update on Digital Camera Technology:

MORE AND MORE ARE GOING DIGITAL

Digital still cameras are now well and truly a technology whose time has arrived, and new models have appeared in a steady stream even in the nine months since our last update. Virtually all of the camera makers are now producing digital models, and they're fast becoming a serious aid to business, in many different fields.

by BARRIE SMITH

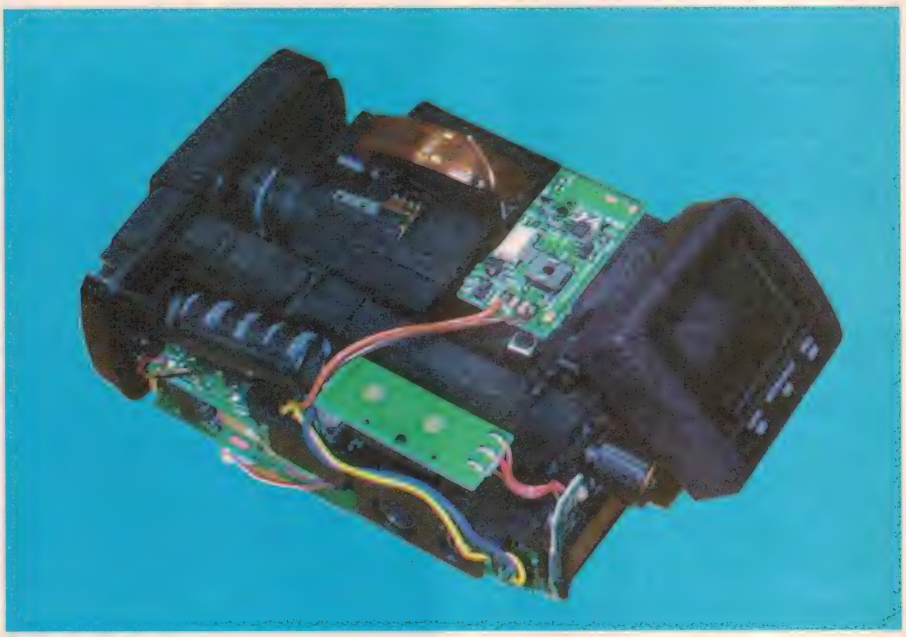
If you thought the digital still camera business was slow moving and still in its infancy, you may be surprised to learn that Australians can now buy more than 30 different models from a dozen or so companies. Mind you, here we're talking consumer digital cameras. The pro side is a little different: Canon/Kodak, Minolta/Agfa and Nikon/Fuji offer 35mm SLR design based models, and there are larger format digital backs available; these offer relatively high picture quality, at considerably higher prices.

But it's consumer digital cameras, priced from $400 up to around $2000, that constitute a growth market and have moved far from the traditional silver-based camera product. It's true that as yet, we're not seeing the 'happy snapper' getting into digital shooting; a few things hold this back. There are, however, many novel applications in business arising from the digital camera's easy computer connectivity.

For many, used to the levels of control provided by even low-priced SLR cameras or even a moderately priced compact model, shooting with a digital camera can be deeply disappointing. Most offer no exposure control, no manual focus and many of those selling for below $1000 have single focal length lenses. And at the end of the day, the hard truth is that you can often extract a larger print from a negative shot with a $15 disposable camera.

But the digital camera is here, it hooks up to a computer and printer with varying ease — and you don't need film, processing and a wait of an hour or two to produce a colour print in your own premises.

So, exactly where are we with the consumer digital camera at the moment?



A Kodak DC120 digital camera opened up to show its innards.

Parallax error

Give people a new toy and immediately they push it to the extremes. Using a budget-priced digital camera to shoot closeups of small items is a big ask, although it is possible with most models. The problem is that once you move in close, you come up against the parallax error problem: the axis of the viewfinder differs from that of the taking lens, often in both the X and Y directions, making it hard to get a properly composed and centred shot.

The inelegant answer to parallax, in this writer's opinion, has been the employment of colour LCD screens to supply the 'virtual TTL' (Through-The-Lens) view of what's going on just centimetres away. LCDs are costly, drain power dramatically and also tend to become near useless when viewed outdoors. Which probably explains why we've never seen one on a compact film camera!

Shots limited

Shot capacity is another restriction. Some, like the bottom line Kodak DC20, can store only eight 493 x 373 pixel images or sixteen 320 x 240 pixel images in the camera's internal Flash memory. Others use expensive removable cards, and can store 20 or so 640 x 480 pixel images on each 2MB card. The new Sony Digital Mavica can hold 20 images of 640 x 480 pixels on a 3.5" HD disk, the first camera to employ the cheap and universal floppy.

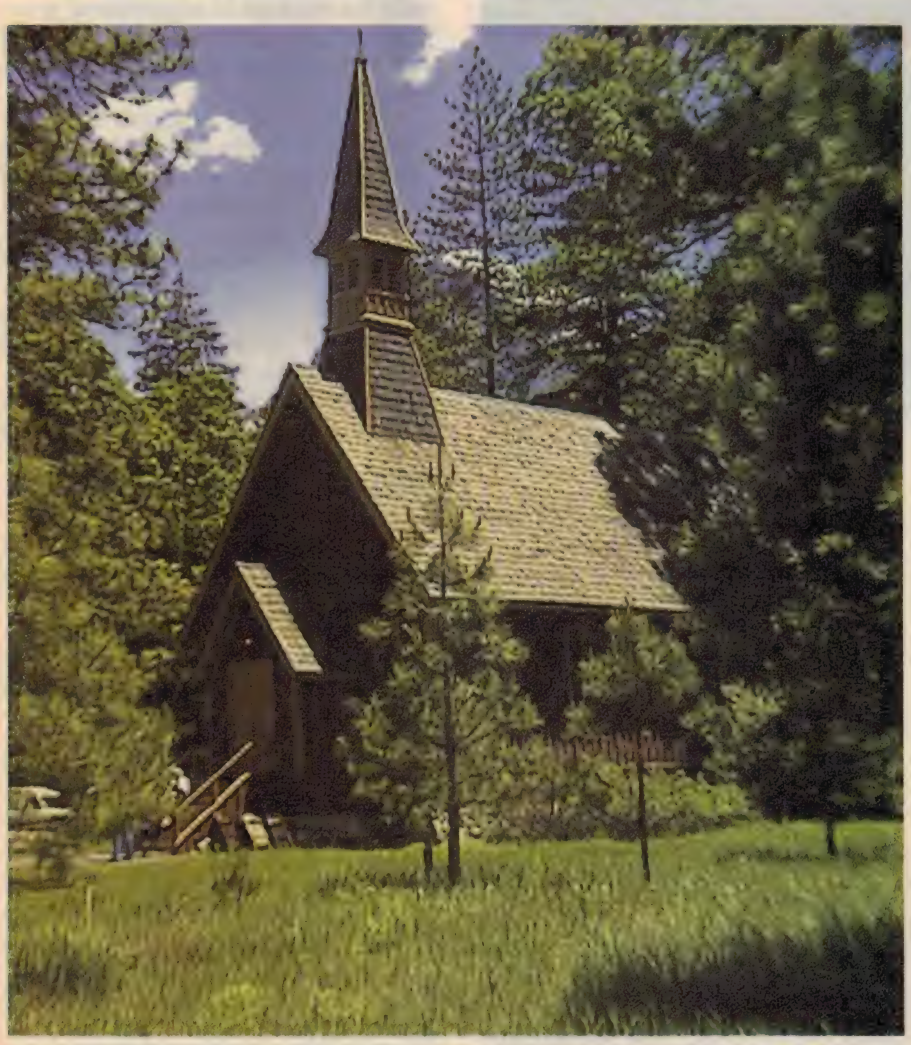
Image quality: OK

The rush to consumer digital cameras is such that, at the moment, quality of image is not a deterrent to the average user. Compression is the order of the day, as JPEG, and in one case MPEG, is used to cram file sizes down to surprisingly low levels. In their QV-10 model, Casio managed to reduce 900KB files to 28KB by accessing only a single scan field of the CCD's output; but, in general, the average uncompressed TIFF file of around 1MB is usually reduced to a JPEG-slimmed 100KB in most camera compression schemes.

At this level of compression, few users complain at the output quality on an inkjet printer. Besides, rarely does a user expect an A4-page blowup from a 640 x 480 pixel image — the 'happy snap' 15 x 10cm print size is the normal requirement.

Compression need not be a problem, when deployed intelligently. This writer regularly submits high quality TIFF files to a number of publications, JPEG compressed from 2MB-plus down to levels of 4-500KB, which end up on colour glossy pages with no apparent diminution in quality. You could certainly say JPEG is a success.

The new Olympus D-500L, featuring a true SLR-type through the lens viewfinder coupled to a 3x zoom lens. It offers 1024 x 768 pixel resolution and stores the images on removable Flash cards.



US maker Vision VLSI has released this image, of a scene captured with its new CMOS-sensor based Vision camera.

The challenge

So things are progressing fairly well, so far. But if the whole digital camera business is to continue to grow, prosper and become a serious and viable challenge to the 35mm film camera, there needs to be change in some areas:

- Image sensors need to pack in more pixels or to become larger, to allow image quality to rise;
- The storage methods must be simpler, less fussy and cheaper;
- A common JPEG (or other standard) compression mode will need to be adopted industry wide, so that pictures from camera X can be downloaded into computer Y, and 'processed' with software Z;
- Printing out digital camera images has to become simpler. The new 'direct camera-to-printer' devices are a positive step in this direction.

There are some other, more subtle issues as well, which we can now look into.

Colour management

Once the initial thrill has passed, users become more critical as they use digital camera images in more demanding ways. Devices such as monitors and inkjet printers have defined 'colour spaces' or gamuts — the principle being that the picture you take with the camera should look the same on the screen as it does when printed out. Red should look like red.

At this stage, consumer level cameras don't have defined colour spaces. Most manufacturers seem to feel this market is less stringent — unlike the pro models. There are systems out there — at the computer level, to manage colour space. Consumer pressure may yet force them into the point and shoot digital camera, as users get more demanding.

Sony's new DKC-ID1 camera shares components with their video camera line-up. It features a 12x zoom lens and shutter speeds to 1/4000th of a second.

Sony's DVC-FD5 and FD7 Digital Mavica models store 640 x 480 pixel images on standard HD floppies.

Resolution wisdom

Conventional wisdom is that you should print a digital camera image only to its pixel capacity. According to this philosophy, a 640 x 480 pixel image should be printed on a 300dpi inkjet or laser printer to no larger than 2.13 x 1.6 inches. But as many of us have found, this can be exceeded — depending on the subject matter and your own tolerance of jaggies and pixel artefacts. Interpolation algorithms in software and similar ingenuity in some inkjet printer mechanisms can tweak the result to surprising levels.

Your digital camera image can look great up there on your monitor — but dotty and grainy when printed out on a low-priced inkjet! If your camera has a CCD made up of 640 pixels across the picture and 480 vertically, it will present an image on your monitor (with a typical 72 pixels per inch screen) of 8.9 x 6.6 inches. However, when you engage with the black art of conventional printing, and its dependence on the dot screen for half-tone reproduction, matters get very touchy.

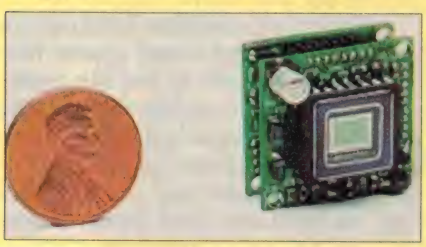
An industry rule of thumb is that the image dpi should be between 1.5 and 2X the line screen figure. An example: give your 640 x 480 image to a printer and ask him to reproduce it on newsprint using an 85-line screen (at 1.5X) and it will reduce to 5 x 3.76 inches. Glossy magazines often use 150-line screens, so the original 640 x 480 image will drop to 2.13 x 1.6 inches.

But enough technical talk. Let's take a look at some of the new digital camera

About CCD sensors

Virtually all current digital cameras rely on CCD (charge-coupled device) sensors for their image input. There are three or four schemes used in this capture activity.

Snapping the shot: A single CCD is used by all consumer digital cameras, as well as by a number of high-end SLR style models. A consumer level CCD will have a diagonal of between 1/4" and 1/2" (6 - 13mm). On taking the shot an image is created on its surface, as with a traditional camera.



CCDs 'see' only monochrome. To create a colour image, a filter matrix — a series of stripes or random mosaic of red, green and blue filters — is laid over the sensor, with a filter on each picture element (pixel) of the single CCD, so each records only one colour. Some have twice as many green elements as red and blue, creating an apparently more detailed image because the eye is most sensitive to green. Software then interpolates the other colours, by taking into account adjacent pixels; but coloured fringes around high contrast edge details can occur.

Artifacts can appear with this approach. An extended smear can arise from bright highlights, streaking across the image. Spurious colour effects and extreme contrast are major problems for less expensive CCDs. Image file sizes get to around 1MB uncompressed.

Cameras that scan: These cameras are very similar to a flatbed scanner. In one scheme the CCD is a single row of sensors that moves from one end of the exposed area to the other, with a change of a filter in front on each pass to capture each colour. In another, there is a separate filtered array for each colour. A stepper motor moves the array over the image area. The full colour image is built up line-by-line. Resulting file sizes can top 100MB per image, but this type of camera is really only suitable for studio 'still life' work.

The big gun: At this point in time, the Phase One digital back is the highest quality unit around. The PowerPhase 4" x 5" back uses a linear CCD capable of producing 6000 x 8400 pixels, using 12 bits per colour. A 24-bit output file at full resolution will reach 144MB.

models, which are well worth inspection.

Sony's Digital Mavica

The new Mavica's recording medium is a 3.5" high density floppy disk, onto which 20 high or 40 standard resolution 640 x 480 pixel images can be held as JPEG files. Two models for this market, the MVC-FD7 and MVC-FD5, are due at year's end. The MVC-FD7 has a 10X zoom lens, and the camera is capable of four in-camera picture effects, like sepia etc. The newcomer will offer auto/manual focusing and exposure as well as five extra Program modes. It has built-in flash, shutter speeds of 1/60-1/4000sec and is both Mac and Win compatible. The MVC-FD5 model will lack zoom, auto-exposure modes and effects.

Sony's DKC-ID1

An unusual beast, this model has a progressive scan 1/3" CCD of 450,000 pixels, 1/15-1/4000sec shutter speed range, full Program AE or shutter exposure priority and exposure compensation (for excessive dark or bright backgrounds) by +/-3 stops in half-stop increments. The lens is an f2-2.8/12X zoom with a focal length range of 5.4-64.8mm.

Startlingly similar to a camcorder, the unit has no internal memory, but uses a PC card. There are two quality levels — fine and normal; each image is of 768 x 576 pixels, but they differ in JPEG compression levels. With a 2MB card the capacity is seven fine or 29 normal shots. At present it suits a 486 or Pentium machine, with a Mac version to come.

Konica's pair

The cute Konica Q-Mini digital camera features a 1.8" LCD screen and stores images on a compact Flash memory card, holding 11 images in fine, 23 in normal and 47 in economy mode. It appears very similar to the Panasonic Cardshot. The more traditional companion model (also badged for Hewlett-Packard) is the Q-EZ, which lacks an LCD screen.

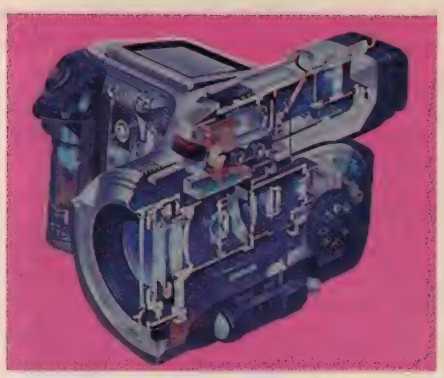
Kodak's new model DC-120 features a 1152 x 864 pixel progressive scan CCD with a 2x zoom lens, and uses a 1.8-inch LCD screen.

Panasonic's NV-DCF1 'Cardshot', which saves its compressed JPEG images on removable Flash cards. It uses a progressive scan CCD and delivers 640 x 480 pixel resolution.

Panasonic models

The Panasonic PalmCam measures just 9 x 6 x 3cm and weighs 158g. It offers an image resolution of 640 x 480 pixels. The f/3.8 lens is fixed focus, but includes a macro option for focus down to 8cm; the shutter covers from 1/8 to 1/20000sec. There's only an LCD viewfinder. The built-in 2MB memory stores 16 high res, 32 medium res, and 94 normal images, stored as JPEGs.

Also available is the Panasonic NV-DCF1, measuring 9.3 x 94 x 5.1cm and weighing 290g without batteries. It uses a progressive scan CCD with 640 x 480 pixel resolution, and records in three levels of JPEG compression. Picture capacity is 11 fine images, 23 normal or approximately 47 economy images. The camera has a tiltable 46mm LCD screen and offers manual and auto white balance



Canon's new Optura stills/video camera uses the DV tape format for image storage. Features include a 14x zoom and an optical digital stabiliser.

Konica's cute new Q-mini camera has a 1.8-inch LCD screen and stores images on a compact Flash memory card. The Q-EZ model is more traditional in shape and has no LCD screen.

as well as auto exposure with manual compensation. Mac and Windows compatible as well as NTSC video output.

Kodak's DC210

Rolled out in September was Kodak's latest entry, the DC210, with a 2X zoom lens, auto flash, a 1.8" LCD display and a 1152 x 864 pixel progressive scan CCD. The company has made its output format compatible with virtually any computer platform. FlashPix file format is employed, as well as JPEG as a second finished file option and also video output. Camera-to-computer communication uses an IR link. A 4MB CompactFlash card is supplied with the camera. Picture capacity is 16 to 60, depending on the settings.

Pentax EI-C90

The tiny (107 x 81 x 27mm, 200g) Pentax EI-C90 records in uncompressed TIFF format or JPEG. The LCD screen is an add-on. A 5.2mm f/2.8 fixed focus lens images onto a 1/4" CCD, capturing a 768 x 560 pixel image in an internal 2MB of flash memory or a PC card. One unusual touch is in-camera horizontal image compensation, to fit the picture to a computer screen aspect ratio.

Hybrid models

A new breed starting to emerge, and possibly to become more common is the hybrid digital still/video camera. Here are some examples:

- Hitachi's MPEG digital still/video camera uses real-time compression and full motion video, allowing PC users to easily transfer recorded video to a PC, then edit and either view the final work or pull out stills. The camera weighs only 540g, records 20 minutes of full motion MPEG1 video at 352 x 240 resolution or 1000 still images at 704 x 480 resolution (plus up to 10 seconds of audio with each pic) and up to four hours of audio. All is captured on a 260MB PC card. At present it's Windows compatible only.

The camera brochure bravely claims that the MPEG compression at 100:1 is 'far superior' to the 5:1 used by digital camcorders.

- Canon grasped the nettle by releasing their Optura still/video camera, using the DV tape format. Ostensibly a video camcorder, it encroaches into the digital stills territory by using a progressive scan CCD which allows stills (and sound) to be captured on six seconds of tape. Shutter speeds of 1/60 to 1/1000 sec are possible in the NTSC model yet announced; the camera can also accommodate an SLR-derived flash unit. A 14X zoom and an optical digital stabiliser flesh out the features.

(*Barrie Smith is editor of Australian Digital Camera magazine.*) ❖

The new Pentax model EI-C90 is very compact and features incamera horizontal image compensation to fit the picture to a computer screen ratio. The LCD screen is an add-on.

Are CMOS sensors next?

Once you dig into the specs of many of today's digital still cameras, you realise that its CCD may have come from a video camera. Such CCDs brings with them some of the same problems: relatively high manufacturing cost, failure rate on the production line, and visual artifacts that while they mightn't be of pressing concern in a moving, changing image, can be annoying in a single frame.

Growing in acceptability is the use of CMOS devices as imaging sensors in digital cameras and video camcorders, enabling a new class of low cost, high resolution devices. The 'new breed' CMOS cameras will inherit many advantages. Lower prices arising from lower manufacturing costs being among them.

The CCD is just one of many components in an imaging system. Integration of an entire imaging system on a CMOS sensor chip could result in most of the image processing being performed in the digital domain.

Already achieved in a CMOS device by developing companies are such functions as A-D conversion, timing, auto exposure, automatic gain control, gamma correction and output signal conversion for video standards such as PAL and NTSC. CMOS image sensors also give cameras the potential for huge power savings over CCD-based systems.

The disadvantages are that current CMOS image devices have residual visual noise and pixel sizes of around 12 to 15 microns, as opposed to 7 to 9 microns for CCDs.

OLYMPUS CAMEDIA P-150E COLOUR PRINTER

The new Olympus P-150E colour printer uses dye-sublimation technology and produces high quality prints with an image size of 109 x 82mm. It can also be connected directly to one of the company's own digital still cameras, as well as to either Windows or Macintosh PCs.

by JIM ROWE

The new digital still cameras are great for capturing images for publication in magazines like *EA*, and also for taking shots which can be sent to the other side of the world via the internet. But soon after you get one, you also realise that many other potential uses depend on your being able to print their electronic images out on paper.

With a suitable colour printer, in fact, your digital still camera can be used to produce prints almost as rapidly as a camera using 'instant' chemistry — and certainly faster than using a traditional film camera and whizzing the film over to your local 'one hour processing' shop...

But what kind of colour printer do you really need? Many of the inkjet models

A sample print from the P-150E, reproduced actual size. The image concerned is a flash shot, and the cat's face was a tad overexposed.

Another sample print, again reproduced actual size. There's very little evidence of 'jaggies'.

that have become popular in recent years are not really up to the job, while the most of the fancy wax-transfer and dye-sublimation models that can deliver the desired print quality are far too expensive. Colour lasers tend to be even worse.

Probably what's needed, as far as most users are concerned, is a relatively small-format colour printer than can produce postcard sized 'photographic' glossy prints, but at an affordable price. If it could accept the image information straight from the camera, as an alternative to printing from a PC, that would be even better.

Well known Japanese camera maker Olympus Optical must have realised this when they were developing their new range of Camedia digital cameras (see the Camedia C-800L review in our September issue), because their new P-150E printer fits the bill quite nicely. It prints high quality 109 x 82mm images on A6 size (141 x 100mm) sheets of special glossy paper, using the dye-sublimation thermal transfer technology previously only used in high-end printers.

According to the P-150E's specification its printing resolution is only 148 x 148 dots per inch, giving a total image resolution of 640 x 480 dots. (The printer electronically converts the image information into this format.) However the apparent resolution of the prints seems to be much higher than this — possibly as a result of the smoothing action of dye diffusion in the paper's glossy gelatin coating. Printing a 1024 x 768 pixel image from an Olympus C-800L camera gave very nice 'photographic' prints, where dots or 'jaggies' were quite difficult to detect unless you used a magnifying glass.

The printer actually uses only three colours: cyan (C), magenta (M) and yellow (Y). There's no separate black or 'K' dye, as used in most colour printing; the blacks are synthesised by overprinting all three colours. You might expect that this would give rather wishy-washy blacks and greys, but in practice the prints look very natural indeed.

The three colours are each rendered in 256 levels — i.e., it gives 24-bit colour printing, with a theoretical capability of 16.7 million colours.

Of course one of the really nice features of the P-105E is that it has both serial and parallel ports and can print directly from one of the Olympus Camedia digital cameras, as well as from either a Windows or Macintosh PC. Printing from the cameras is via their built-in RS-232C serial port, and takes about 120 seconds, while printing from a Windows PC is via the Centronics parallel port and typically takes only 80 seconds or so. Printing from a Mac is again via the serial port, and can apparently take up to 210 seconds.

The printer itself is quite compact, measuring only 232 x 295 x 115mm and weighing around 3kg. There are two slots in the front, of which the upper one takes a small 'cassette' holding up to 25 blank sheets of glossy A6 paper. The lower slot is the exit slot for the prints, and is normally fitted with a ribbed output shelf.

The colour dyes are on a roll of plastic ribbon 98mm wide, which comes in its own cartridge. This slips into a compartment on the side of the printer, and the ribbon gradually transfers to a take-up spindle in the same cartridge as images are printed.

The ribbon has essentially large rectangles of each dye colour in cyclic order, and seems to move only in one direction. It's described as 'non-reuseable', and this does seem to be the case; when the cartridge supplied with the

This final print shows the performance on blacks and greys. The subject was underlit on the right.

Olympus P-150L printer

A compact digital colour printer capable of producing 'photographic' images on A6 size glossy paper. The three-colour (CMY) images have a potential 16.7 million colours and a resolution of 148dpi.

Good points: Nice print quality, due to the use of dye-sublimation thermal transfer technology. Has both parallel and serial ports, for printing from both Windows and Macintosh PCs — and also directly from Olympus' Camedia digital still cameras.

Bad points: Not super fast. The prints will work out at around $1.70 each — a little pricey.

RRP: Around $899, with the P-50E replacement paper/ribbon set around $85.

Available: From digital camera specialists. For your nearest dealer contact distributor R. Gunz (Photographic), 2/26-34 Dunning Avenue, Rosebery 2018; phone (02) 9935 6600 or fax (02) 9935 6622.

printer we were reviewing 'ran out' during our testing, we tried rewinding it a short distance manually to see if we could extract a few more prints. The P-105E certainly did its best, but the prints turned out to be superimposed with 'colour negatives' of previous images...

The dye ribbon cartridge is rated to produce 50 prints. The printer is supplied complete with one cartridge and 25 sheets of the glossy A6 paper, with replacement cartridges available as part of the P-50E 'paper set' — which contains 50 sheets of paper and a dye ribbon cartridge.

In practice the printer is very easy to use. There are only two front panel controls, one the power On/Off button and the other a 'Direct Print' button which is used when you have the P-150E hooked up directly to a camera. (You select the image you want to print using the camera's own controls.) A group of four LEDs indicates Power On, Ready/Printing, Ribbon or Paper End, and Error.

From our experience with the sample P-150E, we found it capable of producing very acceptable prints, both directly from a C-800L camera and from a Windows PC. There were no complaints about the print quality, and while it isn't overly fast, the printing time is fairly acceptable.

The quoted price for the printer itself is around $899, which seems reasonable considering the print quality. However the P-50E paper/cartridge sets are priced at $85 each, so you'll end up paying at least $1.70 per print — a bit steep, but I guess you're paying for the convenience. ❖

ELECTRONICS AUSTRALIA'S READER INFORMATION SERVICE COMPUTER BULLETIN BOARD

As part of its service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS). This makes available a wide range of useful information, for convenient access and rapid downloading by readers equipped with a personal computer and modem. We know that a high proportion of our readers have these facilities, nowadays.

Here's an idea of what's currently available on the BBS:

- Software needed for recent PC-based EA construction projects
- Index files for EA and ETI construction projects
- Recent notes and errata, both published and as-yet unpublished
- Useful public domain and 'shareware' software for electronics and amateur radio applications.
- General interest shareware utilities, such as the commonly-used compression and decompression utilities used for efficient storage and faster file transfer.
- The ability to upload Letters to the Editor, and/or contributions to our Forum and Information Centre columns (send them as plain-text ASCII files, please)
- An on-line 'Discussion Forum' facility, which allows readers to exchange useful technical information directly.

The *Electronics Australia* Reader Information Service BBS is ANSI-compatible and is currently operational for virtually 24 hours each day, seven days a week, on (02) 9353 0627. Your modem can be set to any standard speed from 300 to 28,800b/s full duplex, with a data format of '8-N-1' (eight data bits, no parity and one stop bit).

So feel free to call up the *Electronics Australia* BBS, and take advantage of its facilities. Your only outlay will be the usual cost for a phone call...

INSIDE THE DUNGEON OF AN INTERNET SERVICE PROVIDER

What really happens, when your computer calls up your chosen 'ISP' to link you into the Internet? What kind of equipment and systems does an Internet Service Provider need to have, to provide this service? Quite a few readers have asked these and similar questions — but finding the answers turned out to be difficult, because most ISPs are fairly secretive about what they've got. So we asked Tom Moffat to do a little sleuthing, on your behalf. Here's what he was able to find out...

by TOM MOFFAT

Let's go onto the Internet. You grab your mouse, click on an icon, and your modem starts making dialling noises. Soon you see a message saying 'connected'. But what are you connected to? Nothing, really, except your Internet Service Provider, or ISP. You have *access* to the Internet, but you are never *connected* to anything apart from the ISP.

Not connected? What are you paying your money for, then? Who IS at the other end of that telephone line, and what are they doing?

In this article we are going to explore what makes an ISP tick. A medium-sized ISP in Port Townsend, Washington — OlympusNet — has agreed to lie down on the operating table to be dissected. But before we can do that, we should look at the nature of the product OlympusNet handles — raw data.

Data on the Internet, or most other computer networks for that matter, is sent and received as PACKETS, just like with the packet radio system used by radio amateurs (see *EA*, November 1992). Packets are simply chunks of data, any kind of data, being sent from one place to another over the Internet. They are like envelopes with letters inside; each envelope is marked with the recipient's address, and the sender's address, just like with good old Australia Post.

Every 'device', anywhere in the world, which is connected to the Internet, has a unique Internet address. 'Device' usually means a computer, but it can also be a terminal server, or router, or any other component in the ISP's box of tricks. The address is made up of four numbers between 0 and 255, separated by dots. We won't go into the full addressing scheme here; just keep in mind that no two Internet addresses are alike — ever.

Very Important Point: when your computer is 'connected' to the Internet, it is assigned its very own Internet address, and thus it becomes a PART of the Internet itself. Although a permanent address is sometimes assigned to your computer (I had one when I was doing system administration), addresses are usually assigned only for the duration of one Internet session. Later on, some other user gets that same address.

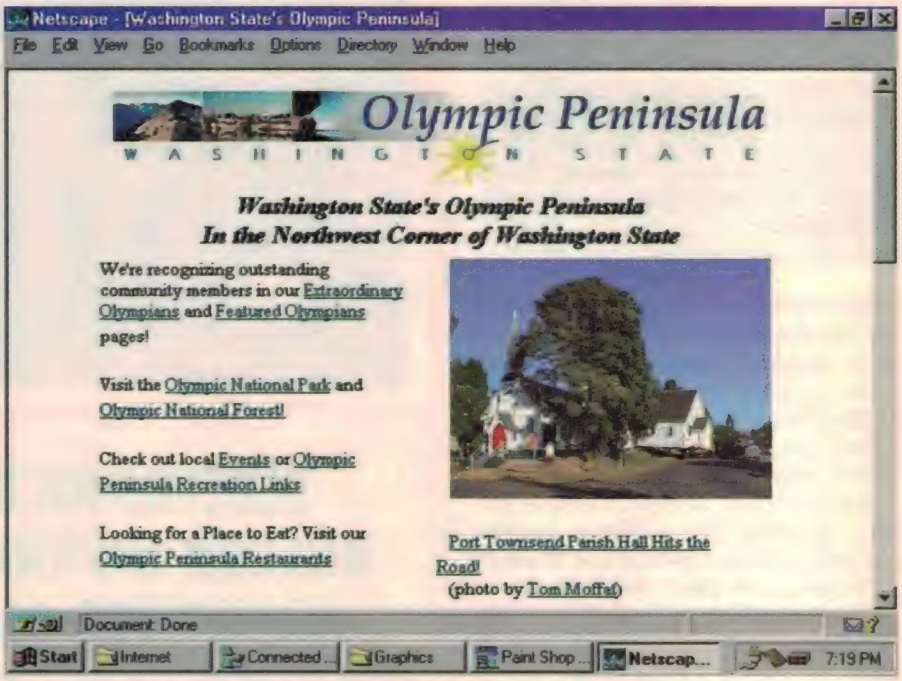


Fig.2: OlympusNet's home page.The photo was taken by Tom Moffat himself, using his digital camera.

With that in mind, observe Fig.1 which is a raw data representation of one actual packet received by my computer. The computer was busy downloading the OlympusNet home page, as shown in Fig.2. The actual data is shown in hexadecimal notation. It does not appear to be ASCII text; hex pairs starting with 4 or 5. So it's probably part of the graphic heading, or perhaps that picture of the church.

The first line of the packet contains the address of the sender (198.133.237.12), and the receiver (198.133.237.48), which was only assigned to me for that particular session. The top line shows that the packet is 512 bytes long, but there are only 472 bytes of actual data, shown in the second line. This is because the first 40 bytes of EVERY packet are devoted to the *header*, which contains address and other supervisory information.

Just after that packet came through, another one followed, carrying the next 472 bytes of picture information. And then another, and another. If the WWW page being accessed was 90KB long (not an uncommon size), it would take around 200 packets to do the job. If you are lucky, these keep streaming though, one after another. But more commonly you get a few packets, and wait, and some more packets, and wait, due to Internet congestion. The problem is that

everyone else is trying to send and receive packets too.

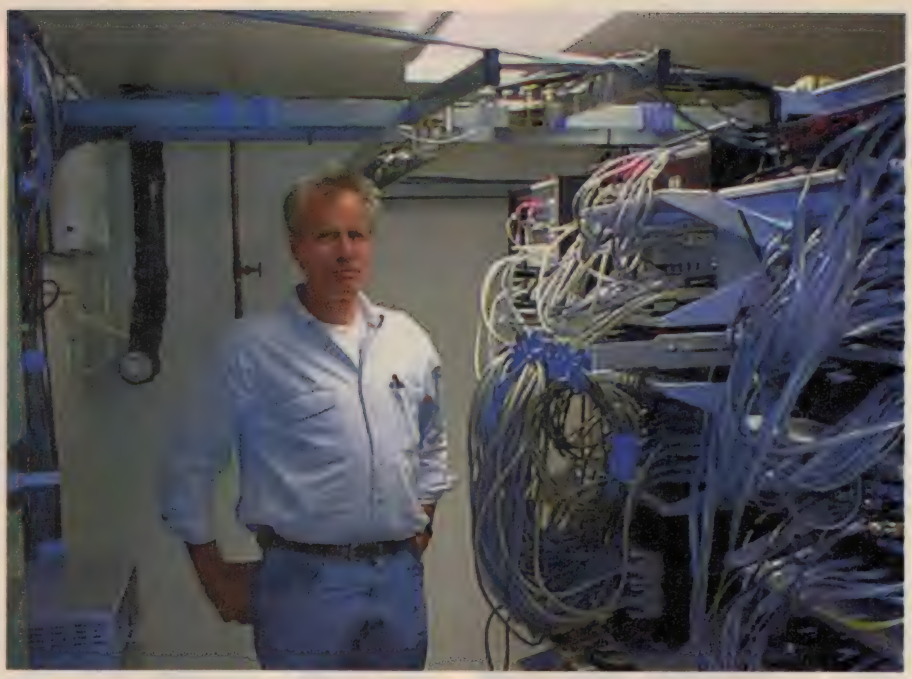
Note that you seldom have to remember those messy numbers. Instead, Internet sites are named — if you want to go to Yahoo, you type **www.yahoo.com** (forgetting the **http://** bit) and away you go. But as you do this, your computer reaches out to a Domain Name Server (DNS) which is simply a big 'phone book' that looks up a name and returns the corresponding number.

When you first set up your Internet software you must specify the address of your intended DNS as a numeric address, because the software can't very well look up a number for a name until it knows where the DNS itself is (or something like that...). A Domain Name Server is usually part of your ISP's system, but some smaller ISP's use another server's DNS. It makes little difference.

Now let's look more closely at that Yahoo connection: You type **www.yahoo.com**, and the DNS converts that to a number. Your computer then starts firing off packets at Yahoo, demanding attention. Your computer displays a message such as 'connecting to server...'.

When Yahoo recognizes you, it begins squirting packets containing its home page toward your computer. You see the page developing on your screen, in fits and starts. Eventually it's all there, and you admire it and think, 'what should I do next?'.

Very Important Point: While you're sitting there thinking, Yahoo is already attending to someone else. Or hundreds of someone elses. You are not physically connected to Yahoo; you simply have its home page on your screen.



OlympusNet owner Ned Shumann with a 'rats nest' of RS-232 cables and phone lines, behind some of the equipment racks.

When you finally decide to click on something on the Yahoo page, you shoot off a packet to Yahoo, and it responds with a further string of packets containing the information you want — probably interspersed with packets for lots of other people.

You get the right packets because *they contain your very own Internet address*. It is yours and yours alone, at least for the duration of that Internet session. And that explains how hundreds of people can be 'connected' to a site like Yahoo at the one time. Because nobody is really 'connected' at all...

```
1 IP 198.133.237.12 ->198.133.237.49  len 512 prot 6
 184.9 80->1030 seq 000082E9 ack 000000A3 ACK  wind 8496 data 472
RCV[0021] 0000:45 00 01 EC 73 B1 00 00 3F 06 9F 11 C6 85 ED 0C C6 85 ED 31
RCV[0021] 0014:00 50 04 06 A5 65 29 70 6C D9 00 A3 50 19 21 30 AD 4D 00 00
RCV[0021] 0028:50 03 62 7B F9 55 A3 62 22 36 D6 98 46 94 50 69 9D 45 74 81
RCV[0021] 003C:52 91 5A B2 A9 95 92 6C 04 21 24 DB 4B CC 35 37 12 2F B4 68
RCV[0021] 0050:32 89 9A 86 9C 54 9D 15 4B F0 40 C4 0A 3E A5 20 60 54 29 A4
RCV[0021] 0064:80 C2 05 75 1A C5 80 03 44 3D B0 81 53 76 1A 55 41 05 78 22
RCV[0021] 0078:AA C2 7B 29 08 C5 E8 06 2A A4 F0 1F 11 35 3C 51 93 45 20 B9
RCV[0021] 008C:35 11 46 1F 2D 12 22 87 9F 15 56 A3 67 A2 26 E6 E9 20 A7 16
RCV[0021] 00A0:A4 50 46 32 46 49 19 87 51 B2 7A 6A 70 78 05 97 97 AD A5 F1
RCV[0021] 00B4:D7 C4 12 3A 2E 11 DA 6A 78 75 DA 21 41 9D 1A 54 6C 41 C5 56
RCV[0021] 00C8:49 E5 5A 56 2A DB EC B2 6D 31 BB 6C B2 D3 56 69 11 41 48 14
RCV[0021] 00DC:21 C3 07 1A 48 80 01 06 10 7C C0 C1 07 22 40 DA 42 0B 2B E0
RCV[0021] 00F0:F9 29 02 7D 22 58 00 95 0A 28 A4 70 C1 03 0D 38 E0 80 7C 16
RCV[0021] 0104:E0 19 04 9E 1D 58 80 82 53 15 3C 00 F0 05 F1 0D 8C 82 10 44
RCV[0021] 0118:18 61 EE C0 04 33 6A 6E 0B 46 20 F1 51 61 49 B4 90 9E 0A 41
RCV[0021] 012C:E8 C8 D7 62 9D DE E5 D7 62 9E B9 D6 97 40 23 BB C8 21 C9 4B
RCV[0021] 0140:6E F6 91 63 9A 51 E6 98 62 4E 04 B7 5A AE 3B A2 56 5A B2 05
RCV[0021] 0154:29 B2 19 95 4B 1E 6B 19 95 93 59 76 AC 6C 95 55 49 D7 44 54
RCV[0021] 0168:52 44 51 A7 B2 85 02 12 B4 6B 4D 74 AC 45 14 71 B9 99 24 5E
RCV[0021] 017C:78 21 8A 16 47 A0 BB C1 C0 7F EE 09 D4 80 E9 D5 60 04 0D 2D
RCV[0021] 0190:70 80 01 07 1C 88 50 02 BA 7A 16 DA 2F C0 0D 58 40 F7 06 28
RCV[0021] 01A4:E0 9D 37 0A 02 D2 6D 41 10 42 1C 71 44 9E 46 6D B0 82 11 3C
RCV[0021] 01B8:2C 81 84 B9 2C E0 29 E0 80 14 68 A0 82 11 03 D5 F8 11 8D 04
RCV[0021] 01CC:81 4C E2 62 A5 92 AC 18 5F 56 10 04 3A 8A 4B FF 05 EB AB 32
RCV[0021] 01E0:6A 36 90 5F 9D DD 6A 44 40 00 00 3B
```

Inside the ISP

Now that you understand the concept of packets, the rest of this stuff becomes easy. OlympusNet has kindly invited *Electronics Australia* readers into their underground computer centre, popularly known as 'the Dungeon'. This is a rare event indeed, because ISP's are normally very secretive; they don't like to let the opposition know what they're up to. In fact *EA* was admitted only on the understanding that this article would not be published in the USA.

Port Townsend is in earthquake country, and the Dungeon is built with massive concrete walls. The equipment is mounted in standard 19-inch relay racks, which are bolted to the walls so that the system doesn't fall over, literally, when the ground starts shaking. There are cable racks near the ceiling which carry the many interconnections between all the components.

Fig.3 is a block diagram of the entire OlympusNet system. At the bottom of the diagram you'll see that everything is closely allied with the local telephone exchange. Phone lines and data lines, and eventually some fibre-optics, all enter here to do their stuff with OlympusNet.

On one wall of the Dungeon are sev-

Fig.1: The anatomy of an Internet data packet, as received by Tom's computer when his browser was downloading the OlympusNet home page of Fig.2. It's probably a block of graphics data.

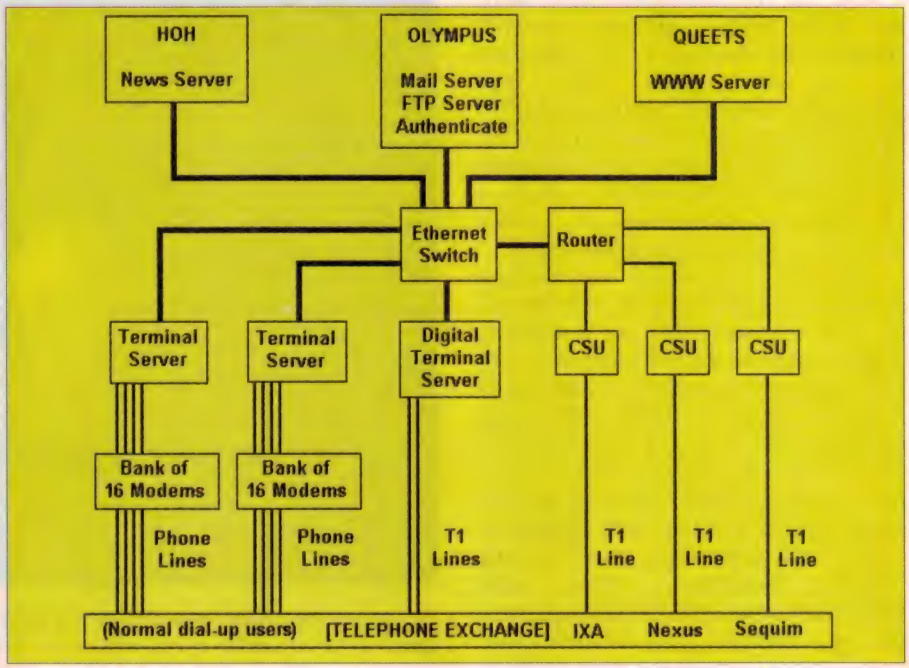


Fig.3: A block diagram of the OlympusNet installation, showing the kind of setup needed for a small to medium ISP.

eral telephone line terminal cabinets, containing about 120 phone lines. Mounted in racks in front of the line cabinets (left side of photo) are several rack units containing 16 modems each. These are mostly made by US Robotics. Each modem has a phone line running over the cable rack and into the wall cabinet; there are lots of them and it's a bit of a rat's nest.

At the digital side of each modem is an RS-232 port, just like on any 'external' modem you might buy at a computer shop. Mounted in the racks near the modems are several terminal servers, known as 'Portmasters', made by the Livingston company. Each modem is connected to an RS-232 port on a Portmaster. The Portmasters have 24 ports and the modem units have 16, so there are two terminal servers for every three banks of 16 modems. (The block diagram only shows a few of these connectons.)

Within the telephone exchange, all the ISP's phone lines are set up in a 'hunt sequence'. The ISP's published access telephone number is assigned to the first phone line. If this is busy, the 'hunt' tries the next line, and if it too is busy, it goes on to the next, until it eventually finds a line which is not busy. If every ISP line is in use, the caller then gets a busy signal and connection is impossible. This is a very rare occurrence with OlympusNet, for reasons which will be discussed later.

The 'Olympus' computer: a Hewlett-Packard 486 net server with 64MB of RAM and multiple hard disks, which is currently OlympusNet's mail and ftp server, and also handles user authentication.

Very Important Point: Although there are 24 'inputs' to each terminal server, there is only one 'output', and this is an Ethernet connection. There is an Ethernet — a small local network — running all around the Dungeon, and every device of any importance is connected to the Ethernet, with each device having its own network address. The Ethernet, in turn, is connected to the Internet. So once you have access to the local Ethernet, the world is your oyster!

You will notice on the block diagram a thing called a digital terminal server. This is a brand new device, not yet configured, which will bring in the new digital phone lines from the telephone exchange. These lines do not use modems as such; the individual incoming phone numbers are multiplexed together on the telephone exchange end, and then transferred to the ISP by high-bandwidth T1 lines, described below. On the ISP end the digital circuits are broken down into individual user connections again, where they are handled in much the same way as traditional analog lines.

OlympusNet currently has 48 incoming lines, connected to three banks of modems and two 'Portmaster' terminal servers.

A typical call

The terminal servers are really the 'front door' into the ISP. They do all the initial dirty work, establishing who you are and 'connecting' you onto the Internet if you turn out to be legitimate. So let's

follow the process as a user makes a phone call to get onto the Internet...

Ring-ring! Somewhere along those many banks of modems, a red light flashes to signal an incoming call. You can see swarms of red lights glowing in the photo. The modem answers, and the computer user soon hears that raucous screeching sound as the modems on each end establish an appropriate connection speed, based on modem capabilities and phone line quality.

At this stage the user is asked for a username and password. This request is coming from the terminal server; the incoming call is nowhere near a 'proper computer' yet. The terminal server makes the incoming user wait while it reaches out across the Ethernet (only a few metres in this case) to a computer named Olympus, where it runs a program called Radius.

Radius looks up the incoming username, and if it is legitimate it compares the incoming password against a stored list. If this checks out too, Radius sends a message back to the terminal server saying, 'this guy is OK, let him onto the Internet'. And then Radius starts a timer, to run up your Internet bill.

Meanwhile, back at the Portmaster, software looks at a bank of Internet addresses it has available, and assigns one to you (for this session). This address is relayed back to your computer, at which time you may see a message saying "my IP address is..." and then a numeric address. Now, your computer has its very own Internet address, and you are ONLINE!

What next? The Olympus Ethernet is shown on the block diagram as a heavy line, connecting all the system components through a gadget called an Ethernet Switch. Normally an Ethernet network is just a big party line, with all devices throwing packets onto it in hopes of them reaching some destination. With all devices trying to talk at once, there will inevitably be some PACKET COLLISIONS, resulting in fatal injuries to both parties. Such packets must be sent again, slowing down the system.

You will notice that in the OlympusNet system, every Ethernet link goes directly into the Ethernet switch, so nothing is allowed to talk directly with anything else. The Ethernet switch acts as kind of a traffic cop, allowing this traffic to pass and that traffic to pass in a fair and equitable manner. Without all those data prangs to put up with, everything moves much faster.

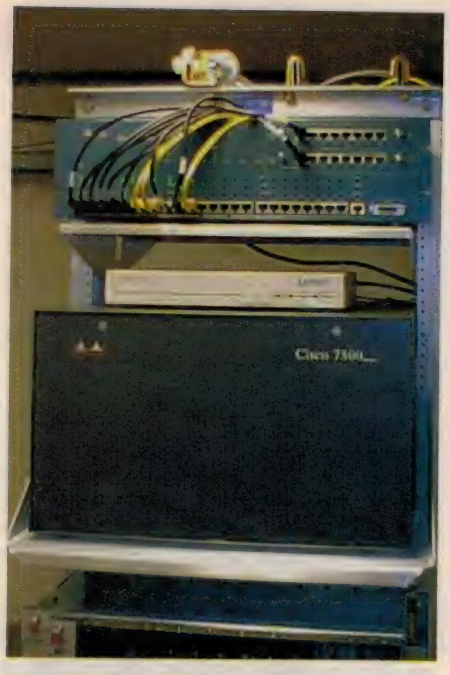
The Ethernet eventually must connect to the Internet, and this is the responsibility of the *router*. The router connects with the Ethernet on one side, and meets the outside world on the other side. The connection to the telephone exchange is via digital T1 lines, which have a top speed of 1.54 megabits per second. (T1 lines are known as E1 lines in Australia.) The T1 lines connect to the router though CSUs, which are essentially 'T1 modems'. Nobody around here seems to know what CSU actually stands for.

OlympusNet has *two* side-by-side T1 connections to the Internet, via two larger ISP's in Seattle: IXA and Northwest Nexus. It's like an airplane with two engines. OlympusNet can stay on the air with only one of the T1 lines, but it flies much better and more reliably when both are working.

Sometimes an ISP in a country area needs to provide local-call service to other communities which would incur trunk charges — a situation which Internet users find intolerable. So the ISP can establish a 'satellite site' in the remote area, as OlympusNet has done for Sequim, a town about 50km distant...

A small building in Sequim contains about 80 incoming lines with a local Sequim phone number. These connect to the usual banks of modems and terminal servers, and then straight to a router and out through a T1 line to OlympusNet. Authentication for Sequim users is done by the Radius program in Port Townsend. (By the way, pronounce the town's name 'SKWIM' and you will sound just like a local!)

The OlympusNet 'Queets' machine, which is currently its WWW server. Most of the black box is a bank of hard disk drives.



OlympusNet's Ethernet switch (top) and Cisco 7500 router (bottom). It's the latter which forms the actual link between the Olympus Ethernet and the Internet itself.

Most OlympusNet users set their broswers to show the OlympusNet home page as soon as they log on. But some prefer to go straight to Yahoo every time, or Microsoft or Netscape or Opera if they haven't bothered to set their home page to anything else. In this case their communication goes straight into the Dungeon through a terminal server, and out onto the Internet through the router, without any further involvement of the ISP.

However, most people's Internet sessions are a little more involved. As they log into the system, the OlympusNet home page appears. They may wish to look at the local weather forecast, and then check their e-mail, and then look for anything interesting on the newsgroups, or perhaps download some software. These are auxiliary services provided by the ISP, and they are usually more important to the user than just the ability to access the Internet.

OlympusNet now has three whopper computers attached to the Ethernet, shown at the top of the block diagram. It seems to be traditional, by the way, to attach nice names to Internet devices. OlympusNet's computers are named after nearby rivers (Hoh and Queets); they would probably be Parramatta and Hawkesbury if they lived in Sydney. Olympus is named after a mountain. Even the terminal servers carry names of trees (Elm, Fir, Ash).

The three present computers are a far

cry from the one beat-up machine called Elwha, which ran the whole show up until two years ago (See Moffat's Madhouse, *EA* March 1997). Elwha was replaced by Olympus, a Hewlett-Packard net server with a 486 processor, 64 megs of memory and multiple hard disks. This one machine carried the can for a further year, supplying services for World Wide Web, e-mail and news, as well as various log-on and housekeeping functions.

Eventually the number of newsgroups grew to the extent that Olympus was bulging at the seams, so Hoh was installed. Hoh was dedicated almost entirely to newsgroups, while acting as a backup for some of the more important material on Olympus.

The latest addition is Queets, a massive machine still being commissioned as this is being written. Queets has a Pentium II processor, 136MB of memory, and two banks of hard disks totally over 16 gigabytes. The World Wide Web server is being moved over to Queets, and once in place it will be expanded to offer some very advanced services to online businesses.

All the OlympusNet computers are based on the Unix operating system, which many would see as a throwback to the eighties. So why Unix, in these days of modern server systems such as Windows NT?

OlympusNet owner Ned Schumann says NT is fine for smaller networks, but Unix is 'industrial strength'. As this is being written, the Olympus Hewlett-Packard machine is carrying the World Wide Web server, as well as Radius, and the mail server, and the FTP server, and trying to handle the requests for service from over 2000 customers.

Olympus is obviously feeling a little stressed with this workload, which is why Queets became necessary. But Olympus is handling the job quite successfully. Ned Schumann says only Unix could cope with this kind of demand.

Overall the company has about 200 modems in Port Townsend and Sequim, to support 2000 users. It seems that with only one modem for every 10 users, the modems would be busy most of the time and many users couldn't dial in. This is often the case with ISP's which offer 'unlimited access' with no connect-time constraints. Users log on and then stay there, sometimes all day. America Online faced a major disaster, and lawsuits, earlier this year when they switched over from timed to unlimited access, and users faced a sea of busy signals.

Ned Schumann sitting in the Dungeon — at the very heart of his subterranean data domain.

OlympusNet solved the problem by limiting each customer's usage to 100 hours a month, with further hours costing 75 cents an hour. Most people never get near the 100 hour limit, but it does stop those who would log on and stay there indefinitely, turning a 'public' modem into their very own private line. The scheme works — busy signals are now unknown on OlympusNet.

Who wants to be one?

So who wants to be an ISP?

On the surface, this sounds like an interesting business to be in. Where else could you start off with one computer and a few modems, and add more users, and more modems, and grow and grow and grow? OlympusNet has grown to the stage that the equipment in the Dungeon, and the Sequim site, is valued at around US$130,000. But the monthly costs to keep all this stuff running, as well as supporting a staff of around 10 people, are about US$40,000.

A lot of the money goes toward upgrading the system — things like providing more and more modems and terminal servers as the OlympusNet membership grows. Ned says the payroll component is fairly small, since staff wages are low (which I can testify to, having worked for OlympusNet).

Ned says his wage is the lowest of all, which is probably true. What he doesn't mention is that his work day usually starts around 5:00 in the morning and goes until midnight. He survives with occasional cat-naps on the floor of his office, and he follows Zen meditation techniques, which help keep him going...

Writing on the wall

Ned Schumann says the writing is on the wall for small to medium ISPs. In the USA at least, they are facing competition from the big operators such as Netcom, and even from the telephone companies.

So far OlympusNet is immune from competition from the big guys, mostly because Port Townsend is at the end of the road, and a trunk call is necessary to access the major services. But Ned feels that the local phone company, US West, is planning to set up its own Internet service before long. The big long distance carrier AT&T already operates a thriving Internet service, but you still have to pay trunk charges to access it from Port Townsend.

So dial-up Internet users are the bread and butter for OlympusNet, for now. But Ned is planning for the future, supplying all kinds of fancy on-line services such as custom message boards and online databases-for-hire, for use of local businesses. These things will sweeten the pot somewhat, for users who might otherwise go with US West or AT&T.

As Ned says, "We are becoming a data company, a software company, not a connection company. It is a huge change." And the current OlympusNet dialup operation is financing this change.

Where will it end? Look out, Bill Gates! ❖

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Cat. No. 8489 **CCD Bar Code Scanner Long Range KB** $439

As well as our standard range.

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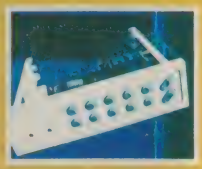
Computer Security Kit



No software required. A small keypad mounts in a 3.5in bay which allows an access code to be entered. Two access codes distinguish the level of user. The floppy drive is automatically locked when accessed by the second user. Keyboard & mouse may be locked/unlocked at any time.

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A high quality FM stereo radio that simply plugs into a serial port while a stereo RCA cable connects to a sound card. An antenna also plugs into the unit. Fully clickable controls enable you to scan the frequencies from 87.5 to 108MHz, tune a particular station and name it as one of ten preset stations.

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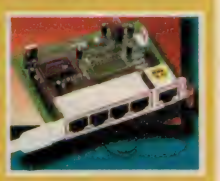
Cat. No. 2239 **2 Port RS232 16550 COM 1-8 IRQ 3-15** $99
Cat. No. 2326 **4 Port RS232 16550 COM 1-8 IRQ 3-15** $295

The dual port card is now available with 16650 UART chips with 32 byte FIFO buffers.

Cat. No. 2333 **Two Port 16650 Serial Card** $149

Ethernet Hub Card 5 Port UTP



Mounts on the backplane of a computer but does not plug into a slot, it only connects to the power supply. No separate case & power supply means reduced costs, plus everything is neat & tidy.

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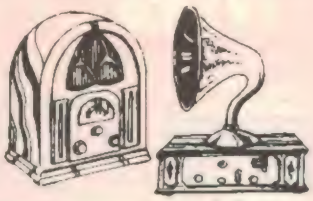
Vintage Radio

by ROGER JOHNSON



Making 'something from nothing'...

One of the real pleasures to be had from vintage radio is identifying an old chassis with a minimum of clues, and then trying to rebuild it. This month's story concerns just such a task, with a forlorn but interesting relic of the 1930's.

Recently an elderly and rather derelict chassis was presented to yours truly, because the donor didn't have the heart to chuck it out, and thought that it may be of some use for the few remaining components to be salvaged. My first reaction was that yet another derelict chassis was needed about as much as the proverbial 'hole in the head', but graciously I accepted the gift and the chassis remained in the heap with the rest of the 'waifs' for several months, until it was necessary to scrounge for some component or other to effect a repair.

Then I noticed that there was something about the chassis that had an appeal. Perhaps it *would* be worth resurrecting, but first I would have to identify it...

The only clues that could give any identification was a rather flourishing 'VR' penned on the cardboard dial, the 'ARTS & P' label on the back, an identification mark 'B17' followed by a serial number, and the valve types stencilled onto the cabbage green coloured chassis. Most of these markings can be seen in the accompanying photographs.

The valve types were types 32, 34, 32, 20 and 19 — all battery valves. The last number '19' also meant that it had push-pull output, because the 19 was a dual triode specifically made for push-pull class B audio output. This all dated the set at around 1934, and a five-valve battery set of this vintage with push-pull output could perhaps be a restorable proposition, even though there was no cabinet. (There still isn't!)

Fig.1: An overall view of the chassis of the 'mystery set', an Australian-made battery superhet of the mid 1930's. It was in a rather sorry state...

Identifying it

I received considerable help in identifying the chassis from Mr Daryl Kasch of Maryborough in Queensland, a member of the Historical Radio Society of Australia who has spent many hours photocopying practically everything that he can lay his hands on concerning radios of the pre-war period. He also has in his files copies of *Radio and Electrical Merchant*, newspaper advertisements of the day and most of the files of the HRSA.

TILBURY & LEWIS PTY. LTD., Wangaratta Rd., Richmond, Vic. J5171. "VAN RUYTEN" Model 103. 5-valve superhet. 175 k/c, employs 34 Mixer, 32 I.F., 34 Det., 30 Driver, 19 Class B Output. "A" battery consumption 0.5 amp. at 2 volts from 40 A/H accumulator. "B" battery drain 7 to 11 m/A from three 45-volt triple capacity B batteries. Rola Permag. Speaker. Controls: Tuning, volume, battery switch. Piano finish console. £24/5/- (Vic. list), excluding batteries.

Fig.4: The small section of a listing of sets given in the July 27, 1934 issue of Radio and Electrical Merchant, describing the Van Ruyten chassis manufactured by Melbourne firm Tilbury & Lewis.

For a very modest fee, Mr Kasch will offer to identify a chassis if he is provided with whatever information the inquirer may possess.

The information on my forlorn relic was despatched in due course, and a reply was eagerly anticipated. The reply came, but alas this particular chassis had defied his best efforts. However Mr Kasch did include some information from the *Radio and*

Electrical Merchant from 1934, giving a 'Directory of Australian Battery Operated Radio Receivers', and wished me luck.

As the chassis had come from Wimmera district, there was perhaps a possibility that it may have been a set made under contract for the Victorian Railways (hence the 'VR'), for use in the recreation areas of the fettlers' huts or carriages — if indeed such a radio had ever existed.

The information in the directory included the manufacturer, the model, a thumbnail technical description, the valve types, battery requirements and the list price, in VERY small type. Certain of the cabinets were illustrated. Not to be deterred, I decided to study all this information in case a match could be made and the identity of the chassis revealed...

Eureka!

Methodically I worked my way down the list, eventually reaching the T's to find: Tilbury & Lewis Pty Ltd, and the brand name 'Van Ruyten'. Here at last I found a description of the valve types which matched the orphaned chassis fairly well. At least the 'VR' on the dial now had some significance. To obtain a circuit should now be a mere formality, surely.

Not so. It appears that NO 'Van Ruyten' circuits were ever published — anywhere! Not only that, despite Van Ruyten sets appearing on the market with gusto in early 1934 and receiving encouraging reviews (Fig.4), they disappeared just as quickly about three years later. A photo in *Radio and Electrical Merchant* for April 12th, 1935 shows merely 'part' of the assembly line in Van Ruyten Margaret Street (Richmond), in a factory of no mean size. The assembly factory was separate again from the manufacturing plant, in which everything possible was made on site, including coils, transformers and chasses.

Remaining problem

What remained was a chassis with slightly conflicting valve types, a model number which was not evident or did not match the existing chassis markings, and a complete void regarding the smaller components. A true 'restoration' was therefore out of the question.

Perhaps, with some intelligent guesswork and using what was left, the chassis could be rebuilt to something approximating to the original. The intention is that at some future time a complete chassis might be unearthed, with which the project can be compared and the necessary alterations made.

Fig.2: Visible in this closer view from the rear are the 'Arts & P' label and some of the other chassis markings — plus some of the rust and corrosion.

Fortunately the dial, the coils and the IF transformers are intact. Otherwise, the project would be pure guesswork, with absolutely no semblance to the original. Also intact were the battery cables and the switch. The 'A' battery pair was there in a rather faded red and black, attached to the ends of two very rusty battery clips. The other cable contained six leads, one of which went to the second pole of the on-off switch. The other pole of the switch was connected to 'A plus'.

This is significant. Very likely, a pair of nine-volt 'C' batteries were used, across which was connected a resistive voltage divider, and this would need to be switched to prevent premature flattening of those batteries. This was standard practice of the day.

Now a few thoughts regarding the valves. In one description, it is stated that the mixer is a type 34, the IF amplifier a type 32 and the detector type 34. On the other hand the chassis markings are for a type 34 IF amp, a type 32 as detector and no clear marking for the mixer. These markings are more likely to be correct. The type 34 is a variable-mu type, and the type 32 was designed as a bias detector/voltage amplifier.

The mixer could have been either type. The first assumption is that it would have been a type 32, which seemed to conform to other manufacturers' choice of a mixer-oscillator. The important thing is that this valve

A New

VAN RUYTEN

5 VALVE BATTERY SET

Considerable progress has been made by **Tilbury & Lewis** this season in establishing the **Van Ruyten** radio throughout Australia. Much of their success has been due to the receivers which they have been manufacturing. To this line has now been added a 5V battery receiver which the trade should find an easy seller.

Van Ruyten model 103 is a 5V battery superheterodyne of modern design, employing highly efficient output stage using type 19 valve. An undistorted output of 1.5 watts with an average 'B' drain of only 7 milliamps is thus possible. The high sensitivity and selectivity necessary for country conditions is amply taken care of by a preselector stage in addition to an intermediate frequency of 175k.c. There are seven tuned circuits.

The average battery consumption is .5 amps at 2 volts and 7-11 milliamps at 135 volts. Standard battery equipment consists of 2 volt 40 amp. hour accumulator and three 45 volt Triple capacity B Batteries. Valves are types 30, 32, 19 and two 34. The receiver is fitted w t' a full size **Rola** permagnetic speaker, and is housed in an attractive walnut cabinet of pleasing design. At £24/5/0 Victoria, and £27/5/0 interstate, this set offers wonderful value.

It has that extra gain in selectivity, and volume, that make it a superior proposition for the country dealer.

Tilbury & Lewis have great pleasure in offering this set to the trade, and will be pleased to supply folders upon request.

Fig.5: Another item from the Radio & Electrical Merchant for 1934, discussing Van Ruyten receivers.

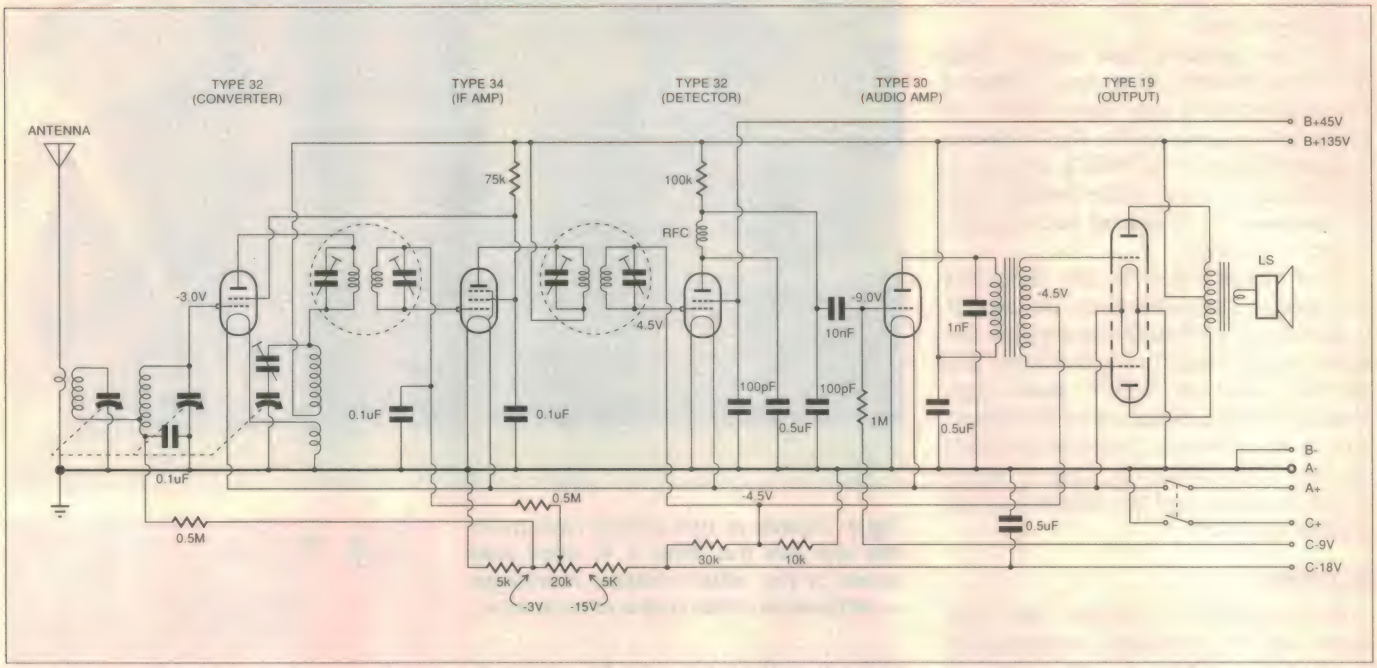


Fig.6: The complete 'reconstructed' circuit for the set, as discussed in the text. Hopefully it's quite close to the original, but there's no easy way to confirm this at present.

would operate with fixed bias for maximum gain and oscillator stability.

Front end & audio

Because the coils are intact, together with the associated wiring, it is a fairly easy matter to trace out the front end. The IF is stated as 175kHz, hence the need for a pre-selector tuning arrangement. The oscillator is an 'autodyne' arrangement and the coil is wired for a 'filadyne' oscillator.

The audio end would have been a type 30 voltage amp transformer-coupled to a type 19 operating in class B push-pull. There was really no other way, at the time, to obtain the drive and coupling to a type 19 output valve.

What about the screen voltages, grid bias and volume control scheme? In order to deduce the voltages it is necessary to refer to published valve data and use the clues provided by the manufacturer. Those clues are a 'B' battery consumption between seven and 11mA, and the fact that the set was provided with three heavy duty 45V batteries. This means that the mixer and IF amplifier could only draw 1.0 to 1.5mA each, the detector about 0.5mA, the audio driver between 2.0 and 2.5mA and the rest by the output valve under no-signal conditions.

The valve data for a type 34 states that with a screen voltage of 67.5 volts, -3.0 volts grid bias and 135 volts on the

(Continued on page 33)

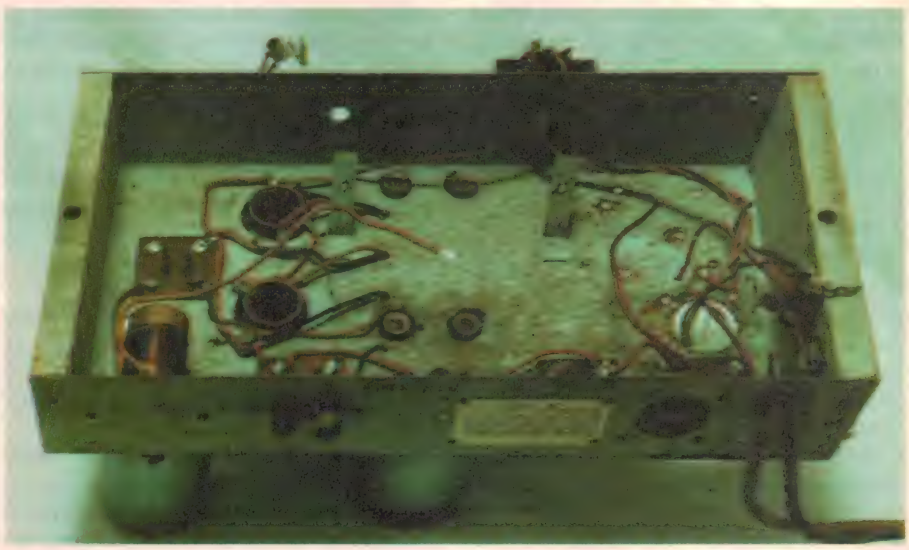


Fig.3: There wasn't a great deal left under the chassis, either. With no published circuits available, this presents quite a challenge in terms of restoration.

NEW BOOKS

Radio Data System

THE BROADCASTER'S GUIDE TO RDS, by Scott Wright. Published by Focal Press (Butterworth-Heinemann imprint), 1997. Soft covers, 235 x 154mm, 208 pages. ISBN 0-240-80278-0. RRP $75.

An introduction to the Radio Data System (also called the Radio Broadcast Data System, or RBDS) which has been widely adopted in both Europe and North America — and may perhaps end up here, eventually. In case you haven't heard, it's a system of using a subcarrier on FM broadcasts to convey streams of digital data, especially intended for mobile listeners: traffic information, station and programme ID, regional tuning information, time and date, emergency warnings and so on. Almost every FM broadcaster in Europe supports RDS, along with about 700 US stations.

The author of this book is a recognised authority on RDS, and was in fact a pioneer in its development. He designed the first RDS receiver for Delco Electronics, and is currently Chairman of the US National Radio Systems Committee RBDS Subcommittee as well as a member of the EIA's RDS Forum. He was therefore in an excellent position to write a sound and authoritative book on the subject, and seems to have done exactly that.

It's written for both technical and non-technical people, and seeks to give a balanced picture of the full potential of RDS — how it works, the benefits for listeners, the advantages for broadcasters and so on. At the same time there's no shortage of technical detail for the interested technical reader.

The style is pretty concise, but still quite accessible. For anyone wanting to get a good grounding in RDS, it would be an excellent choice.

The review copy came from Butterworth-Heinemann Aust., of 22 Salmon Street, Port Melbourne 3207. (J.R.)

Communications

TECHNICIAN'S GUIDE TO ELECTRONIC COMMUNICATIONS, by Frederick L. Gould. Published by McGraw-Hill, 1997. Soft cover, 186 x 234mm, 353 pages. ISBN 0-07-024537-1. RRP $59.95.

According to the author, this book is written for communications technicians, not engineers. It assumes a basic knowledge of electronics and electrical theory, and has very little mathematics. Instead it has lots of illustrations and a non-mathematical explanation of the subject matter. The level would very likely also suit beginners in electronics who want to learn about basic communications.

The first three chapters cover the history of communications, basic components and their applications. Components described include the capacitor, inductor, transistor and the valve, which gets quite a bit of coverage in the book. The next chapter deals with transmitters, and covers AM, SSB and FM. There are only a few circuit diagrams, but lots of block diagrams.

Antennas and related theory are presented next, followed by communications receivers. As with transmitters, there are quite a lot of valve circuits, many of which seem rather out of date. The superhet AM receiver is the only receiver presented, but it is described in detail. Safety is given a complete chapter, and is followed by a chapter on general maintenance considerations and troubleshooting. Ship and shore installations are discussed in Chapter 9, and the last chapter deals with today's communications systems, such as the mobile phone, personal pager, CB radio, Internet and so on.

Being a US publication, the broadcast frequencies given in the book are specific to the US, as are some of the communications services that are described. In general, the book presents the basics of AM communications (with some reference to FM) in an easy to read way, with numerous tables and diagrams (of varying quality).

The review copy came from McGraw-Hill, PO Box 239, Roseville 2069. (P.P.)

SW listening

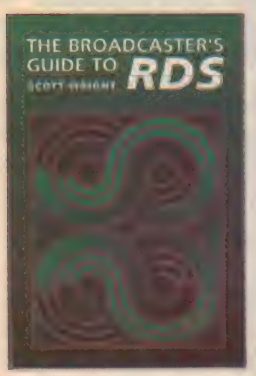
SHORTWAVE LISTENER'S GUIDE, by Ian Poole. Published by Newnes (Butterworth-Heinemann imprint), 1997. Soft covers, 235 x 155mm, 192 pages. ISBN 0-7506-2631-3. RRP $39.95.

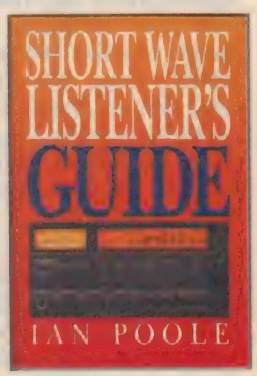
An up to date and informative introduction to the basic theory and practice of shortwave reception, for those who either want to engage in listening as a hobby, or need to do so as an adjunct to their work. Author Ian Poole is an experienced electronics/radio engineer in the UK, who has also become well known as a contributing writer for a number of British electronics and radio magazines.

In this book he has provided a highly readable introduction, which should be quite helpful even for people with very little existing background in radio technicalities. There are 10 chapters in all, beginning with a look at radio waves and their propagation and progressing through receivers, aerials and ancillary equipment through to the practicalities of setting up a listening station and operating it. There are also three appendices, with listings of ITU callsign prefixes, amateur radio prefixes and call areas.

There are a reasonable number of pictures, diagrams and data tables to support the text. All in all, then, it would make a good choice for anyone wanting to 'get into' shortwave listening.

The review copy came from Butterworth-Heinemann Aust., of 22 Salmon Street, Port Melbourne 3207. (J.R.) ❖





High-performance MIDI music synthesiser:

KORG'S NS5R

Offering a huge number of instrument voices in its 12MB of waveform memory, the Korg NS5R synth module features 64-note polyphony and the ability to function as a 32 channel multi-timbral tone generator. It also has 47 different digital effects, including chorus, reverb, delay, overdrive and rotary speaker. Put this together with enhanced General MIDI, GS/XG compatibility and the ability to expand even further using a Wave Blaster compatible daughter board, and you have a 'band in a box' that's very suitable for almost any kind of serious work.

by JIM ROWE

Korg's NS5R Synthesiser Module uses the same PCM-sample based AI² synthesis system used in the company's highly respected 01/W, X2/X3/X5 and i2/i3 Music Workstations, where the synth is combined with a keyboard and sequencer. Here you get just the main synthesiser engine in a compact (218 x 242 x 45mm) but sturdy (1.8kg) box, suitable for connecting up to systems with computer-based sequencers and separate MIDI controllers.

Although at first glance the NS5R may not look much different from a lot of the other half-rack 'band in a box' units that have appeared in the last few years, a closer look shows that it actually offers plenty of features to lift it out of the general pack. For a start, the internal 12MB program/patch ROM contains sampled waveforms for some 1049 different instruments — starting with the full GM (General MIDI) level 1, and adding not only a full set of alternative GM instruments but a huge number of other voices as well. As if that's not enough, there's also provision in RAM memory for another 128 user-programmed voices.

By the way, included in those 1049 voices in ROM are 286 drum and percussion voices.

Since the NS5R has 64-note polyphony, there's also the option of making up 'combinations' of multiple voices, for even more flexibility. In fact the ROM already contains 384 such preset combinations, along with 31 different ROM drum kits. A further 128 combinations can be programmed into the user RAM. Up to eight voices can be used in a combination, split using note-span or velocity windows if desired.

If all this still doesn't provide enough flexibility, there's also the option of adding a Wave Blaster compatible daughter board, to add even more voices...

All of this multi-timbral versatility is made available as a 32-channel tone generator, which can be driven directly from a keyboard or other MIDI controller, from a self-contained MIDI sequencer or from a computer. At the rear of the unit there's MIDI IN, THRU and OUT connectors, but to make it easier to drive the NS5R from computers, there's also a mini-DIN connector which can be used to connect to the serial ports of either IBM-compatible or Macintosh PCs. This requires a suitable cable, and installation of a matching software driver.

Quite apart from the multiplicity of instrument sounds and combinations available, the NS5R also provides very powerful (digital) note-shaping/expression/modulation and effects capabilities. Each channel has its own multi-parameter VDF (filtering) and VDA (amplifier) facilities, to control virtually all aspects of note playing, and the output signals then pass through two

fully independent stereo digital effects units. These can easily be used to provide effects such as reverb, delay, chorus, distortion and 'rotary speaker', as well as allowing placement of the effects. Effects unit parameters can be stored independently for each program and combination sound.

In short, it's a very powerful little music box indeed. And despite this power and flexibility, it's also (relatively) easy to drive, thanks to a reasonably large bit-mapped and backlit LCD screen, on the front panel. This has a resolution of 144 x 40 pixels, and is reconfigured by the inbuilt microcontroller to present a fairly friendly and intuitive 'user interface' in each operating/programming mode.

At you can see from the photo there's a keypad of nine buttons, together with a rotary control used for selection between multiple choice options. Among the NS5R's nice features are a 'Tone' (test note) button to allow easy monitoring of voices/combinations, and an adjacent 'GM Map' LED to confirm when the NS5R is in standard General MIDI map mode. There's also a 'Demo' button which allows you to get the NS5R to play back one of its two inbuilt 'showoff' pieces.

Korg NS5R Synth Module

A very powerful 64-note/32 channel GM-plus music synthesiser using Korg's AI² PCM-sample technology. Comes with 1049 voices and 384 voice combinations in 12MB of ROM, and room for another 128 user-programmed voices in RAM.

Good points: Provides both MIDI and RS-232C serial data interfaces, for computer work. Large backlit LCD display on front panel, two powerful DSP-based effects units inbuilt.

Bad points: Fairly expensive; the case seems to get rather hot after the unit has been running for a while.

RRP: $1499.

Available: Distributed by Music Link, 42 Victoria Street, North Richmond 3121; phone (03) 9429 9299, fax (03) 9427 0740.

Trying it out

We checked out the NS5R with two different MIDI controller keyboards, and also a couple of different computers — using my own little MIDI Breakout Box. We were thus able to give it quite a good workout, sampling a lot of its voices, combinations and effects facilities. I was also able to perform a few A/B comparisons using my Kawai GMega synth box, with cabling and switching to compare the sounds when both boxes were playing the same MIDI files.

Frankly the NS5R gave a very good account of itself, even when playing with the standard default GM map. The Grand Piano (01) voice was perhaps not *quite* as satisfying as the Kawai's, but on the other hand the flute, reed and brass voices were exceptionally good. As an organ lover from way back, I also found the ChurchOrg1 (20) voice surprisingly good.

We found it quite easy to adjust basic parameters via the front-panel controls and display, although like many other units some of the more in-depth programming still seems to be fairly complex. Luckily the NS5R comes with sound editor programs for both Windows PCs and Macs, which should make many of these operations somewhat easier to negotiate.

All in all, we found the NS5R a very impressive synthesiser. It should certainly be of great interest to anyone wanting a 'more flexible and powerful' synth box for serious computer-based music work, although at the price quoted it's also at the upper end of the price range for such units. ❖

VINTAGE RADIO

(Continued from page 30)

plate, the valve draws a total of 3.8mA, which is in excess of the estimate stated above. One certain way to reduce plate current is to reduce the screen voltage. Valve tests indicate that if the screen voltage is reduced to 40 - 50V, the anode current is reduced to just over 1mA. Similar results are obtained for the type 32, which draws even less plate current.

It is not recommended practice to obtain the screen voltage for a single type 32 from a series dropping resistor, because of the very small amount of screen current drawn. However, if a dropping resistor was used to drop the screen voltage for both a 32 and a type 34 together, then that might be acceptable.

The second assumption is, then, that the screen voltage for the mixer and IF amp is via a common screen resistor of about 75kΩ. The screen voltage for the type 32 detector/amplifier would most likely have been from a 45V tap on the HT batteries. The current consumption is negligible, and in practical terms would have no effect on flattening that particular battery from where the tap is taken. The correct bias for a type 32 operating as an anode-bend detector is to adjust it such that the anode current under no-signal conditions is 0.2mA. More on that later.

As for the type 30 driver and type 19 output, the data recommends that the type 30 operates with a plate voltage of 135V and a grid bias of -9.0V. This would draw about enough anode current to meet the stated amount, so the fourth assumption is that the type 30 bias is -9.0V.

The type 19 output stage would need to operate at a bias of somewhere between -3.0 and -4.5V. The turns ratio of the input transformer from primary to each half-secondary is stated as 2.66:1. The type 30 detector would need -4.5V bias, which could be taken from the same source as that for the output valve.

The volume control would probably have been via a potentiometer varying the grid voltage to the type 34, within the range -3.0 to -18.0V. The grid voltages would largely be obtained by a voltage divider network across the 'C' battery, thereby requiring that battery to be switched.

With a sprinkling of bypass capacitors, RF chokes and an anode load for the type 32 of a stated value of 100kΩ, a coupling capacitor and grid leak, we now have the complete reconstructed circuit as shown in Fig.6.

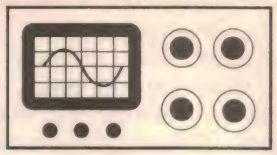
The six battery leads, apart from the 2.0 volt filament leads, are disposed of as (1) B+ 135V; (2) B+ 45V; (3) B-; (4) C+ (switched); (5) C- 9.0V; and (6) C- 18.0V. The drain on the C batteries has been calculated to be about 1mA. The values of the bypass capacitors have been assumed, in conformity with practices of the day.

There we are! What seemed to be nothing more than a candidate for the trash can has been a source of pleasure, sleuthing out a rather unusual circuit. It also demonstrates that with a little diligence, it is possible to create something out of virtually nothing. All that remains now is to see if the beastie actually works! As was previously stated, this cannot be classed as a true 'restoration' in that there is nothing with which to compare it.

Mind you, if there's anyone who has one of these sets and would be kind enough to draw out the original circuit, this would be greatly appreciated by the author — for obvious reasons. I don't suppose anyone out there might have a surplus cabinet, as well?

Oh well, it was worth a try! See you next month. ❖

THE SERVICEMAN



Undoing the damage of a 'machete & pliers' backyard repairer!

The stories I have for you this month are certainly a bit different, with one of our contributors telling of his experiences in remote Irian Jaya trying to repair electronic equipment using very limited resources — and 'competition' with even less, augmented by a frightening lack of knowledge! We also have a tale about a 'for sentimental reasons' repair on an elderly radiogram, which gives a new meaning to the saying...

This month's column should perhaps have been called 'Back when...', since both contributors spend much of their time reminiscing about past events. But I think you'll find them very interesting — I know I did.

The first story comes from Kevin May, of Watsonia in Victoria. Kevin began his letter with some nice words about the magazine and this column in particular, then went on to write about his experiences in a jungle village in western New Guinea. If you think you have problems with customers and their 'Do-it-yourself' efforts, read about what Kevin has to say on the subject...

I would like to set down a few thoughts that may be of interest to your Serviceman, drawn from the seven years I spent in the village of Abepura, in Irian Jaya, working as a field linguist. I have often thought that I should put them down in writing, and now I've actually started. (See! It's easy once you've begun to write, isn't it? Ed.)

Perhaps I should say at the outset that I was not trained as a service technician, but rather as a power engineer. But having an interest in electronics led me to do what I could to help out people with faulty equipment.

Many families in the jungle village where we lived had radio-cassette machines which had cost them a year's income. However, they soon found that they could not fix their problems, although they did try.

Before we went to the village in 1978, anyone with a fault in his radio would either take it to someone in town (two days' walk away, or find the money for a taxi fare), or open it up himself and probe around. 'Someone in town' was often a man with a sign outside his house saying he did repairs.

I visited one of these people once, and noticed that his tools consisted of a pair of long-nosed pliers, a screwdriver and an old multimeter. There was no sign of soldering equipment. Broken connections were repaired with neatly-tied knots in the ends of the wires. Village people, being poor, couldn't afford to go to a better-equipped and therefore more expensive workshop.

But if a man opened up the equipment himself, he used his only tool — a machete. Inserting the point carefully into the dividing line around the case, he would lever it apart. There would be a satisfying crack as the case came open, usually leaving behind no more than a little bit of plastic under the head of each recessed screw.

Holding the case together again afterwards was simple — a strip or two cut from a discarded inner-tube could be stretched around the whole thing.

Having got it open, he could poke around and look for any broken wires to knot together (with or without removing the insulation!), or perhaps some 'loose' screws to tighten with the point of the machete. The results were totally predictable!

Once I had set up my home in the village to begin language study, a constant stream of radio-cassettes were brought to me in this condition with the request "Could you fix it please?"

I had made a rule very early on: "If you have opened it yourself, I won't touch it!" I had neither the equipment nor the experience to realign grossly maladjusted RF or IF circuits, nor any circuit diagrams. But I did have a reasonable set of tools, a multimeter, AND a soldering iron.

Often the problems in the sets I accepted were straightforward — a stretched or broken cassette drive belt, a broken dial cord, a wire broken off a record-playback head, or corrosion in the battery compartment. Such things could be easily fixed and people were so grateful. Unfortunately, some sets I just had to give back with an apology, which was always accepted.

Backyard repair

Once, and only once, I agreed to try and fix a machine that had been interfered with internally. It was a Philips cassette recorder. The owner simply said it had been working and then stopped — so it sounded like it would be something simple.

I soon saw that 'repairs' had already been attempted by one of the back-yard merchants in town. It was incredible! Wires had been pulled off everywhere and just knotted together. Literally nothing worked...

First I restored the connections to the

battery box and loudspeaker with a bit of solder. A quick check showed that if battery voltage were applied direct to the motor it would run and the tape transport seemed OK mechanically. So far so good.

But all the wires had been pulled off the record-playback switch and tied back on, any old how. I sent away for a copy of the circuit diagram. Then I could really make progress.

Restoring all the wires to their proper places brought some life to the speaker, so evidently the amplifier was still working. But the motor wouldn't run when the tape control was switched on. This must have been the fault that had stopped it in the first place.

The machine turned out to have an auto-stop function, controlled by a segmented disc under one tape spindle. A square wave voltage was picked up by two tiny, gold-plated contacts running on the disc. While the spindle turned, this voltage was amplified and used to hold off the auto-stop mechanism. When the square wave stopped, normally due to the tape running out, the system shut down the motor.

Careful inspection showed that the tiny contacts, and the disc they ran on, were simply worn out. I sent away for parts, and in time they arrived and were duly fitted. Lo and behold, a tape recorder working again! A bit of a clean up and it was back to a very grateful owner.

But what a mess had been made of the machine, in a mindless and fruitless search for the problem. I counted a total of 21 faults created by the alleged 'repairer'. Total time to fix it, including waiting for diagrams and parts, was four months. You can guess why I never took on another job like that!

There are many hazards to electrical equipment in the tropics, and I don't just mean dampness, mould, and corrosion. I have had to remove cockroaches caught in mechanisms, and lizard eggs in light fittings. I have straightened out a cassette recorder's sliding controls after a coconut fell on them.

Termites make nests in things, antenna wires are for rats to chew through, or for ants to march along into the house, or for fruit-bats to hang from. We had a dipole antenna for our 5MHz radio link to the office, and one night someone's pet cockatoo chewed through the co-ax.

'A pint's a pound'

Some of our American colleagues had a special tape recorder designed to assist language learning, using an endless tape loop in a special auxilliary cassette. They were made by Canon and designated 'Repeat-corders'.

Over a period of about a year, four couples each arrived with one of these machines and one by one they came to me because they wouldn't work in Abepura. They had plugged them in to the mains and nothing worked. "What could we have done?" they asked.

The machines were fitted with American-style plugs with two parallel flat pins, for which the shops had plenty of cheap adaptors to the local two-round-pin sockets. After all, electricity the world around comes at 110V 60Hz, doesn't it?

(Several times I have heard an American rhyme saying "A pint's a pound the world around" — which works well if the world's boundaries coincide with the coasts of the USA, and you are inside it! Imperial pints — remember them? — were widely used in the rest of the world and weighed 1-1/4 pounds, not one pound.)

Unlike the version of the recorder sold in Australia, which had a 240V mains option fitted, the American version had a transformer for 110V only, with no tappings. And the supply in Abepura was 220V at 50Hz.

Fortunately in each case only the transformer primary failed, without taking the electronics with it.

I made a standard modification for them with a local replacement transformer (with 220/110V tappings) and a voltage changeover switch squeezed into a corner of the case. Then when the owners moved on to where supply was 110V, the machines could still be used.

And here's another hazard I didn't anticipate. One enterprising lad in the village wanted to use up the last bit of energy in some old batteries. Normally they get a little more use from them by warming them by the fire for a while, but what then? Why, use more of them to increase the available voltage!

The lad in question got a piece of bamboo into which he put no less than eleven batteries, with wires held to each end by the inevitable rubber bands, and tied to the contacts in his radio's battery compartment.

Even with depleted batteries the voltage was way over the nominal 6V for the machine! But somehow the transistors in it survived, perhaps because of the high internal resistance of the battery string.

Finally, I'd like to relate what was one of the most simple but intriguing puzzles I faced there. It's not electronic but electro/mechanical, and it presents a story that might be of some interest.

There was a guesthouse in town with eight upstairs bedrooms, each provided with an overhead fan. The fans all came from one batch, installed when the guesthouse was built a year before we arrived. All worked normally except the one in room 8, which ran so slowly it was quite ineffective.

The guesthouse manager, a former TV serviceman from the USA, had tried everything to get this fan working. He had replaced the controller and the motor, but to no avail. He even tried putting the fan into room 7 next door, and there it worked perfectly. He suspected there was some peculiarity in the wiring of room 8, so when I arrived, I was quickly asked to have a look at it.

I tried swapping first the controller from room 7, and then the motor, but the result was the same. Whatever worked

well in room 7 would run slow in room 8 — and there was no difference in the way the rooms were wired. Now I don't believe in ghosts, but my faith was being shaken. What was going on? There had to be a logical explanation for it.

Then the penny dropped. In order to swap the fans around, we first had to remove the blades then take down the motor and carry it next door. But we were putting the same blades back in each room. After all, they were identical, exactly the same size. Or were they?

Placing one blade from each room on a table in the dining room, as a makeshift plane surface, I measured the angle of set on each blade. There was a difference, but it amounted to less than two degrees!

It appeared insignificant, but it wasn't. A quick swap of the blade sets made the fan in room 7 run slow, and that in room 8 become normal. Apparently one blade set was made for a higher-powered motor, and had become mixed up with those for the motors we had. We obtained a set of the correct blades and the problem was solved...

We had been looking at the electrical aspect of the situation, which is hardly surprising, but it took our attention away from mechanical matters. And only by careful measurement could we distinguish between the blades. In every other respect they were identical — size, weight, shape, and finish.

But what a difference that couple of degrees made to their performance! The torque needed to turn the ones with the higher angle was rather more than the motor was able to provide, so the fan could never reach its proper speed.

Well, over the years we have used stories from a number of remote locations, but Kevin's tale must be from the most primitive of them all. Imagine — trying to repair a radio cassette with a machete! And no soldering iron.

I knew that people in remote jungle villages owned and valued their radio sets. And from time to time those radios must need servicing. I had just never given a thought to how that service might be delivered. Now Kevin has filled in the details. Thanks, Kevin.

Labour of love

And now to a story from closer to home.

I have often mentioned items being repaired for 'sentimental' reasons, but I have never before seen those reasons spelled out in such heart-warming detail as in our next story. It comes from Keith Walters, of Schofields in NSW.

In fact, the servicing part of this tale could have been told in 50 words — whereas Keith goes on for nearer 2000 words! But all those extra words paint valuable background, to a human interest story unlike any we have used in this column before.

Here's what Keith has to say...

Occasionally we are all asked to try to resurrect an old electronic appliance for sentimental, rather than economic reasons. In most cases the average serviceman will try to demur, politely (or otherwise), since this sort of job can easily turn into an expensive, unprofitable and ultimately futile exercise.

Unfortunately, this has become very much a knee-jerk reaction, to the point where the average serviceman won't even consider looking at the appliance in question. They tend to see only its 'scrap metal' value, losing sight of any emotional attachment that may be involved.

Needless to say, all this was prompted by a recent personal experience.

A few months ago I was married and in the preliminaries to the wedding, I spent quite a bit of time at my future mother-in-law's home. As is the usual fate of we technical people, I was kept fairly busy for a time fixing up the assorted crook TVs, radio cassettes, dodgy light fittings etc that people accumulate.

Anyway, at one point the conversation came round to my penchant for 'kerbside shopping' for discarded TV sets, and my future sister-in-law had a sudden thought: Could I keep an eye out for an old record player which might have a stylus for her Mum's stereogram?

I had actually seen the appliance in question, but had never taken much notice of it. It was a Precedent 'Three-In-One' with a valve monochrome TV and a solid-state radiogram with the ubiquitous BSR record changer. A beautiful piece of furniture, but it had fallen into disuse with the coming of colour TV.

"I don't have to scrounge one", I said, after examining the ceramic pickup cartridge. "I can get you a new one for about six bucks!"

The W.E.S. Components catalogue has a whole page devoted to stylii — most costing under $10. They even have an 'LP/78' model that fits many of the popular ceramic cartridges. (And a good range of cartridges, too).

This was met by a baffled silence. It turned out that they'd been assured by more that one TV repairman that there was no possibility of fixing the thing; tape decks and CD players were so cheap these days that it was ridiculous to spend money on an old clunker like that, etc etc.

Which I suppose is a fair enough comment, if the music you want to listen to is available on CD or tape. Unfortunately this isn't always the case...

I duly ordered the stylus and fitted it on my next trip up there. The turntable had seized up from the years of idleness, but a few drops of sewing machine oil sorted that out.

A bit of work with a Scotch-Brite pad on the rubber idler wheel to restore its grip and it was up and running, for the first time in about 15 years.

(Just for fun, I also got the TV section going by replacing the 6AL3 damper diode. It works amazingly well, considering it's about 30 years old)!

Meanwhile my fiance and her mother were busily dragging out an enormous collection of 78 records. A quick wipe with Mr Sheen (great for quietening noisy old records) and they were playing as well as they ever did. And what an amazing change they made to the old lady!

Brought her out

Her English isn't all that good and we hadn't really talked much about her personal history. The old records seemed to bring her out of her shell.

She was born in the Ukraine and had been taken from there by the Germans in the early 1940s to work on their farms — virtually as slave labour. Life was very hard but as she said, at least they weren't being shot at.

When the war ended she and a Polish man she'd married spent some years in a refugee camp. With their homelands devastated, all contact lost with their relatives and two young children to consider, they decided their only option was to emigrate.

Canada was the preferred choice, but it had a long waiting list. Nobody knew anything about Australia but you didn't have to wait to go there, so after a nightmare succession of overcrowded ships and refugee camps, they eventually arrived at the holding centre in Greta, north of Sydney, with virtually nothing more than the clothes they stood in.

The conditions there would probably seem primitive now, but after what they'd been through, they seemed positively luxurious!

To pay for their passage, all her husband had to do was to work on a

Government specified job for two years, which must have left him wondering what the catch was! (The fact was that after the war there was a severe shortage of manpower and indented migrant labour was the Government's way of getting essential work done.) They moved to what was then the small country town of Riverstone (now a suburb of Greater Sydney), where she found a part-time job in the local meat works.

What has all this got to do with the record player? Well, you have to understand the isolation these people felt. There weren't many Polish people in the area and no Russians. At the time Australia was firmly in the grip of the 'Reds-Under-the-Bed' mentality, so mother pretended to be Polish as well.

After years of war and near-starvation they had little understanding of the relatively easy-going lifestyle enjoyed by most Australians. They had no concept of credit or mortgages — they thought the only way to own a house was to save up and buy it. Which they did, first living in a rented house with two other families until they'd saved up enough to buy a piece of land and put a garage on it, then living there until their house was built!

They kept chooks and a vegetable garden and they largely lived off that, supplemented by canned 'seconds' from the meatworks.

Eventually more migrants arrived and a small Polish community formed. By this time they decided they could afford a few luxuries. Dad found a music shop in the city which sold Polish dance records, so they invested in a radiogram (which also had short-wave bands, so they could listen to broadcasts from 'home').

My wife still cringes at the memory of it all. They used to have these weekend-long parties: tables groaning under tons of garlicky-cheesy food and endless varieties of continental sausage, all washed down with large amounts of red wine.

None of this would rate a second glance in this 'multicultural' era, but it was regarded with extreme suspicion by the beer-swilling 'meat-and-three-veg' Australians of the time.

And of course there were the never-ending records with Dad, after he'd had a few glasses, dragging the nearest unfortunate female up and down the narrow hallway in an improvised polka or Viennese Waltz. Or he and his friends singing along until the wee hours.

Things went well for them after that, and when their children grew up and had families of their own, between them they bought some land on the north coast and built the house my mother-in-law is living in now. Her husband was offered early retirement, so they were able to buy out their children's shares in the house and move up there permanently.

Sadly, his years of toil in a cement products factory yielded a harsh reward. He died shortly after his 65th birthday of lung cancer, from the decades of inhaling asbestos dust.

In his last few months they'd wanted to make some tapes of the old records, to give him something to listen to during his long spells in hospital. But they'd been given the impression it wasn't possible. Obviously if they'd pursued the matter something could have been done, but they weren't to know that...

Now coming back to the present, I agreed that making a tape would be the most obvious approach. Technically, this presented some interesting problems. The stereogram actually had a DIN socket with 'tape in and out' connections, and I was able to make up a patch lead for a 'ghetto blaster' with RCA line inputs.

The audio sounded fine on the cassette recorder's speakers when I was recording, but on playback the music was barely audible — buried well down in a lot of hiss and noise. I can only surmise that high frequency noise components from the ceramic cartridge were upsetting the recorder's AGC system. In the end I found I could get far better results by just using the recorder's inbuilt microphone in front of the speaker.

On a subsequent trip I took up a hifi deck with manual controls, as well as a proper 78 stylus, which gave far better results. Nevertheless, the family was thrilled with my first efforts.

So if there's an emotional attachment to an old recording, the memories will shine through the scratches, the surface noise and lack of audio bandwidth.

By the way, you could tell which were the old man's favourites — they were the ones almost completely worn out! Interestingly, there were a few tracks that they rarely played, and honestly, on those it was hard to pick them as old 78s!

I can appreciate that this sort of job may not be regarded as appropriate for a full-time serviceman. (Although I must say, my mother-in-law was perfectly willing to pay.) Nevertheless, old turntables often aren't all that hard to fix, and it's just the sort of thing an enthusiastic amateur could cope with without risk of getting into too much trouble.

Maybe you can find something in a council cleanup that can be pressed into service. They say vinyl's making a comeback anyway!

Whether you do it for a few dollars or just a couple of home-made apple pies is up to you. For me it was enough that, just for a moment, the old lady was back in that narrow smoky hallway doing the polka with her 'old man', as she always called him...

Recently I pulled off another miracle for the same family — transferring some old super-8 home movies to video. But that's another story!

Keith, that was probably the most rewarding story I have ever presented here. As I mentioned earlier, 'Sentimental Reasons' often seems insufficient excuse to undertake a repair job. But once we know the full story behind the sentiment, it takes on a whole new meaning.

As a matter of interest, I recently attended a party to celebrate the 82nd birthday of the father of a younger colleague. The old man wasn't taking much interest in the proceedings, until three of us got his old (Precedent) radiogram going again and began playing some of his 40-year-old 78s. It really made the old chap sit up again.

Incidentally, we didn't have any machine oil for the turntable spindle — so we used a drop of olive oil, from the salad dressing!

Thanks Keith, and may your mother-in-law long enjoy her music. ❖

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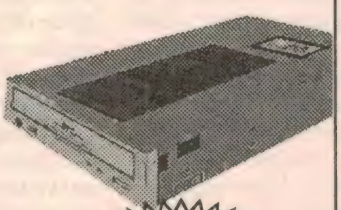

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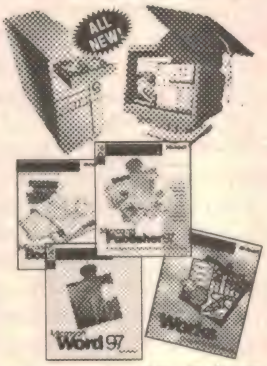

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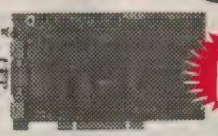

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EA Aug'97

K10860 $8.45

ALL NEW!

A "NO FRILLS" ACTIVE ANTENNA

Designed purely for use with the popular 49 to 13 metres shortwave bands, and does away with a lot of excessive circuitry. The result is a cheap, low cost antenna that gives good performances using only a short whip antenna

ALL NEW!

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FLICKERING FLAME

This little lighting gimmick was used by the dozen at a recent school eisteddfod. It uses a 12V 20W halogen lamp/reflector fitting mounted in a plastic drink bottle filled with red cellophane. A group of these gives a convincing imitation of fire, hence the name "Flickering Flame". SC Sept'97

ALL NEW!

K10910 $20.75

PHONE CONTROLLED REMOTE POWER SWITCH

When connected to a modem, this low-cost project will activate its 240V AC outlet when a pre-determined number of rings occur on the phone line. Dubbed the Remote Power-up, it's ideal for communication sessions between PCs where the remote "host" is normally off- a far more secure way to leave an unattended PC and its valuable data. The unit has an automatic or manual shut-off feature, is easy to build common off-the-shelf parts, and can be used for a range of other remote power control tasks. *Jumper box is included. EA JUN'97*

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ALL NEW!

Kill pain with TRANSCUTANEOUS ELECTRICAL STIMULATION

Do away with analgesics and alleviate pain electronically with a TENS Unit. This produces pulses of current into electrodes placed on the skin adjacent the painful area and has a success rate on most sufferers. The TENS unit provides the necessary features and is considerably cheaper than commercially available units.

SC Aug'97

CASE MAY VARY

ALL NEW!

K10875 $71.95

LOW COST SIMPLE WAVEFORM GENERATOR

This compact unit produces both square and triangle waves over the frequency range from 100Hz to 20KHz. Build it and use it to test audio amplifiers, filters, tone decoders and digital circuits.

SC Jul '97

ALL NEW!

K10855 $21.25

ADDRESSABLE CARD FOR DRIVING ONE STEPPER

This interface card allows you to drive a stepper motor using software control. It plugs into your PC's parallel port and you can connect up to eight units in daisy-chain fashion. *SC Aug'97*

K10880 $40.95

ALL NEW!

5-DIGIT TACHOMETER

A highly flexible tachometer circuit that should cope with virtually any engine or rotating machinery. It has a crystal timebase and a resolution of one rpm.

ALL NEW!

K10900 $106.45

INTERIOR LIGHT DELAY FOR VEHICLES

ALL NEW!

Fit this project to your car and the courtesy lights will stay on for an extended period after the door is closed, then fade out gracefully. It's small, low in cost, can be installed without cutting any existing wires, and can be configured to suit virtually any cars. *EA APR'87*

K10830 $8.45

THE MINISTROBE: USING THE WHITE LED

This little project take advantage of the White LED's bright white light, its high efficiency and fast response time. The Ministrobe can effectively "stop the motion" of almost anything running from 400 to 4000rpm, such as electric motors, car engines, electric mixer.

EA Aug '97

ALL NEW!

K10870 $24.45

AUDIO FREQUENCY SHIFTER

Here's a new low cost design for a unit which can be of great assistance in controlling feedback ("howl-round") in public address and other sound reinforcement systems. It operates by shifting the audio spectrum by 5Hz, and features a very low noise and distortion over a full 20Hz to 20kHz bandwidth. *EA Aug '97*

SHORT FORM

ALL NEW!

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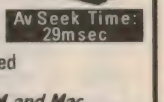

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FORUM

Conducted by Jim Rowe

The pay rates and status of technicians, auto-transformers and static-sensitive ICs...

I have three topics for you this month, only one of which we've discussed in recent times: the pay rates and status of electronics technicians in Australia. The other two haven't been aired for quite a while: whether or not there's a safety problem with 240V/120V autotransformers, and why static-sensitive ICs and other devices can easily be 'zapped' before you buy them.

You may recall that in the July issue, and earlier in the March issue, we ran letters from various people discussing the subject of low pay rates and status of electronics technicians in Australia. Many of these letters were responding to, and basically in support of, a somewhat anguished letter I had published in the June 1996 column, from a reader who asked to be identified as 'P.R.' This reader was an experienced technician who had returned to Australia after some years abroad, only to discover that advertised pay rates for electronics technicians were in some cases less than those for street sweepers...

Although many of the earlier letters certainly gave the topic a healthy airing, they were virtually all written from the point of view of technicians who were either self-employed, or working for small servicing organisations. That's why I've decided to take up some of this month's column with the following letter, which comes as you'll see from someone with a different point of view — that of a technician working in a large manufacturing plant.

The reader concerned is Mr Mark Wilson, of Lara in Victoria. Here's what he has to say:

I am writing this letter in regard to the subject of technicians and what training and payment is needed in the repair of electronic equipment, which you have been discussing in your Forum section for some time. I will give a little bit of background on where my colleagues and I work and what we do, as this may help in understanding what I am writing about.

We work for a large automotive company and are employed as 'A' grade electricians. Our job in the company is to repair any electronic equipment that has stopped working or requires repairs. Below is a list of some of the equipment that we repair:

AC and DC servo drives and controllers
Spindle drives and controllers
Microprocessor based weld controllers
Switch-mode power supplies
Monitors (from monochrome to colour computer monitors)
LCD display units
NC (numerical controlled) machines, from the basic single-axis up to six-axis and spindle drives as well.

As most of the equipment used in our company comes from all over the world there is a vast amount of different types of equipment, makes and models from all the machine builders from the different countries.

Basically anything that has electronic components in it and needs repairing, we are given the task to fix it. Sometimes we have circuit diagrams to help us repair the equipment, but a lot of the time we have no diagrams at all and have to try and repair it anyhow. On all these types of equipment we faultfind down to component level if necessary.

In regard to our education in electronics, most of us have completed the 'Basic Electronics' Course, also the Technician Certificate conducted by our local technical college. A few of the fellows have gone on to do further studies in the electronics field, and other fields as well (Advanced Certificate, engineering courses). But basically we have come from a tradesperson background, and have advanced into the electronics field as a progression in our work capabilities.

We are not paid any extra money for working in the electronics field. We are paid on the same level as the rest of the electricians in our company.

In regard to the discussions that have already gone on, I would like to add these comments. Since we are employed by a large company and are paid a weekly wage, we do not have the worry of cash problems as some of the service people in their own business would have. Also the time it takes us to repair the equipment is not as critical as the service people for whom time is an important issue, when they come to charge the customer for the repairs to the electronic equipment they are repairing.

We have the added benefit of belonging to a union that has a large membership and is not easily messed around with, plus all the benefits of working for a large industrial company. With regard to this, the company can only employ 'A' grade electricians to carry out any work on any piece of equipment that is supplied by and contains electricity and electrical and electronic components.

The company also benefits from this arrangement, for they save a lot of money with us being able to repair the faulty equipment. Some of the servo drives and NC equipment runs into several thousands of dollars for new ones. They also save in the downtime of machinery, which if it is stopped for whatever reason, can stop the production lines running and thus no components are being made — which results in vast amounts of money being lost, depending on how long the equipment is stopped.

Most of the time we will be able to repair the faulty piece of equipment within a reasonable amount of time, thus saving the company money and lost production time. Hopefully this will give you an appreciation of the type of work that we are involved with.

Thanks for those comments, Mark. It's interesting to see the way things are seen by you and your colleagues, and I appreciate that there's quite a difference

between the situation for yourselves in a large manufacturing plant and someone trying to earn a living as a self-employed technician servicing domestic electronics gear. All the same, it doesn't seem entirely fair that despite your additional skills, you are still paid at exactly the same rate as electricians. This doesn't value your electronics knowledge and skills very highly, does it?

But are they safe?

Changing the subject, I've recently had a letter from Sydney electronics technician Phil Allison, who has also contributed some project designs to *EA* over the years. It turns out that Phil is rather concerned about the way at least one firm is marketing mains stepdown transformers of the auto-transformer type — but not, it seems, making this sufficiently clear. Here's what Phil has to say:

Please consider the following information that has concerned me for some time now, ever since I discovered that the Arlec brand 240/120 volt stepdowns were in fact auto-transformers. They are not advertised as such and are on sale at Jaycar and elsewhere.

The letter from Arlec in response to mine published in 'Connections' is most telling. In my opinion they do not understand the risks of using auto-transformers, or even basic principles of mains safety. To claim that danger created by a simple missing or reversed neutral is not the fault of their transformer is absurd. The whole point is that auto-transformers do not have to fail in any way in order to be unsafe to use, and that missing or reversed neutral situations normally present no user hazards.

The instruction sheet that Arlec put much faith in contains no specific safety warnings at all and will typically be thrown away with the packaging. The three-pin US type outlet permits, of course, earthed and non-earthed appliances of any vintage to be connected. Some unfortunate users of an Arlec auto-transformer will find out the hard way which appliances are unsafe to use.

The main facts are:

1. All low voltage transformers and power supplies sold to the public in a ready to use form, e.g. plugpaks, must have type approval and the appropriate numbers marked on the units.

2. General purpose stepdown transformers with voltages over 50 volts can be approved under AS3108 but only isolation types are permitted, this is non-compulsory. Special purpose units like those for toys and shavers require approval.

3. General purpose auto-transformers cannot be approved at all under AS3108 or any other standard. They are effectivly a totally prohibited item under AS3000. (see photocopies)

4. Auto-transformer stepdowns have been sold in the past only to 'the trade' and usually with no power plug fitted — presumably so they can be installed inside the 120 volt equipment.

5. Why are Arlec selling auto-transformers? Presumably because:

(a) There is at present no law to stop them.

(b) They don't know what the risks are.

(c) Since the 120-volt appliances one might use with a stepdown transformer are illegal to sell in Australia, there is no way to deal with their usage or misusage.

6. Is this not a crazy situation?

I trust that the above will prove an interesting and no doubt controversial item for Forum, provided it is not too mortifying!

Thanks for those comments, Phil. If I understand the situation correctly, the main reasons for your concern are that (a) by its very nature, a stepdown auto-

transformer provides a conductive current path between one side of the 240V mains supply and the 120V load circuit, which a transformer with separate primary and secondary windings doesn't do; and (b) at least some of the older overseas-sourced 120V equipment which might be connected to these transformers may have one side of the supply connected to the frame. I agree that these two factors in themselves would provide a significant safety risk when an autotransformer is used — even when neither the transformer nor the 120V equipment has an identifiable 'fault'.

By the way Phil refers in his letter to a previous one he had published in the November 1995 issue of a magazine called *Connections*, and he sent a copy of that for reference. He also included a copy of a page from the February 1996 issue of the same magazine, with a response from the Chief Engineer of Arlec Technical Products Division, Mr Michael Nimmervoll, and an extract from AS3000-1986, confirming (in section 4.28.4.2) that autotransformers are prohibited from being used for 'reducing or controlling the voltage to equipment which is liable to be handled in normal use'.

Static protection

Changing the subject again, let's consider something that we haven't looked at for quite a while: protection of static-sensitive ICs and other devices from damage due to electrostatic charge. Not so much from damage in circuit, but rather from damage before they get into circuit — and in particular, during their journey from the manufacturer to you.

The subject has been raised by reader Mr John Harvey, of Clermont in Queensland, who has this to say:

It's probably a hoary chestnut by now, but I was hoping to interest one of your regular columnists in the topic of failures in static-sensitive IC's.

By way of background, I think my own work practices are sound. My bench top has an antistatic mat which I'm tied to by my metal watch band, and the mat is connected to my CRO frame (through one megohm). Naturally the CRO is at mains earth, as is the soldering iron (WTCPS). Additionally I consciously wear cotton clothing and all metal tools in use reside on the mat; furthermore an evaporative air conditioning system ensures reasonable humidity levels most of the time.

My current suspicions were aroused a while back when I ordered the bits and pieces to build your 'TV Derived Frequency Reference' from a well known national supplier. The ICs arrived loose in a clear plastic bag, legs entwined as if in various mating positions. Needless to say they were promptly returned to sender, along with an uncomplimentary note followed by a telephone call.

They came back again on antistatic foam and in an antistatic bag, but these may well have been the very same ones because after a couple of weeks doing what it ought a 74HC86 died suddenly, or at least the gate used as the phase detector did.

Replacement 74HC86's were ordered from another supplier and came on antistatic foam, but the first one fitted was dead on power up — the gate which controls the phase meter this time. A third device actually worked and continues to do so.

I chose this example because it involves the statistically improbable 'two in a row'; unless of course the likelihood of the first one is very high, which other experiences lead me to suspect might be the case.

Are my suspicions founded, who's to blame and what's the solution?

Thanks for those comments and observations, Mr Harvey. And yes, I think your suspicions are indeed justified, because I've certainly seen for myself — on many occasions — CMOS and other static-sensitive devices jumbled up in the plastic drawers in the stores of various electronics retail chains, and without any apparent attempt to protect them from electrostatic charge damage.

Of course I've also seen these devices correctly protected using carbon-loaded charge dissipative foam, or the thin aluminium foil and expanded polystyrene laminate which seems designed to do the same job. But if I had to quote percentages, I'd say that I've struck unprotected devices at least 35-40% of the time...

It's a worry, isn't it? I know that at times I've only bought some of the devices in question because I've been desperate to get at least one good device, to get something working — and with the strong suspicion that some of the devices I'm buying are likely to have been damaged already.

What's the solution?

But who's to blame, and what's the solution? Those aspects are not so easy.

Virtually all of these devices will be in pristine condition as supplied by the manufacturer and their distributors. However at this stage they're generally in bulk, and either in compartmentalised bands/spools or those long 'tubes' — in each case made from static-dissipative plastic.

The problem is that in order to be sold to customers in small quantities, the devices then have to be transferred from this original packaging. And this is generally going to be a manual operation, with warehouse or retail store employees removing them from the original bulk packaging and transferring them — ideally onto pieces of carbon foam or that aluminium/polystyrene laminate.

I'm only guessing, of course, but to me it seems pretty likely that it's this transfer operation where the devices will either get damaged, or be placed in a situation of increased risk.

For example will the people charged (sorry!) with decanting them from the bulk packaging always take the correct precautions when they're performing this operation? Will they always make sure that the devices are transferred to dissipative foam or laminate? Judging by what many of us have found in the shops, I suspect that these aspects are almost impossible to ensure, even in the best run companies.

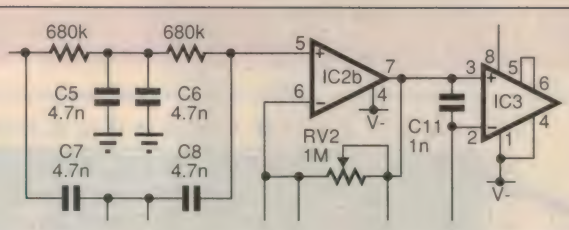
Then there's the problem of customers removing devices from their static-protective foam, in the stores themselves — for their own reasons. This aspect is almost impossible to control too.

So what's the solution? I don't really know. From a practical point of view, I suspect that probably the only way you can be really sure of buying known pristine devices is to buy them in bulk, in the original protective packaging.

Perhaps somebody else can come up with another solution. If so, I'm sure we'd all like to hear about it (even the electronics retailers, I imagine). ❖

$10 Wonders

by OWEN BISHOP



9 - Spinning lights

This month's project uses the principle of 'chaser' lights to produce a display of LEDs apparently spinning round in a circle, reversing direction every five seconds. It makes a fascinating decoration to hang on the Christmas Tree, or you can fix it to the front door or stand it on the bar. Wherever it is, it will help keep the festive mood alive.

Just in time for Christmas is this spinning light display that can mounted on top of the Christmas tree, on the front door, or anywhere else that needs a bit of Christmas cheer. As it stands, the spinning lights display produces a 'walking ring' effect on 15 LEDs, but with a little ingenuity it can be expanded to drive almost any set of lights in an eye-catching and effective display.

The circuit

Fifteen LEDs are mounted in a ring on a circular panel. At any instant every third one is glowing, as the LEDs are powered in three sets of five, each set being switched on in turn to give the illusion of motion. Fig.1 shows the circuit, where the circuit's timing is provided by IC1, a CMOS 12-stage binary divider with built-in clock.

With the resistor and capacitor values shown in Fig.1, the clock runs at about 100Hz. This frequency is divided by 16 to give about 6Hz at Q4 (pin 7). The output from Q10 is around 0.1Hz (once every 10 seconds), and is used to reverse the direction of spin. You can use other capacitor or resistor values to produce different clock speeds, or you can use two of the other outputs from the dividing chain of IC1 to obtain a wide range of spinning effects.

IC2 is an eight-stage shift register. It accepts serial or parallel input and you can take the output from stages 6, 7 and 8. We need a sequence that is a multiple of three, and so we feed back the output from stage 6 to the beginning of the chain of registers.

To start with, a high input on pin 9 loads the registers with the following pattern (from 1 on the left to 8 on the right):

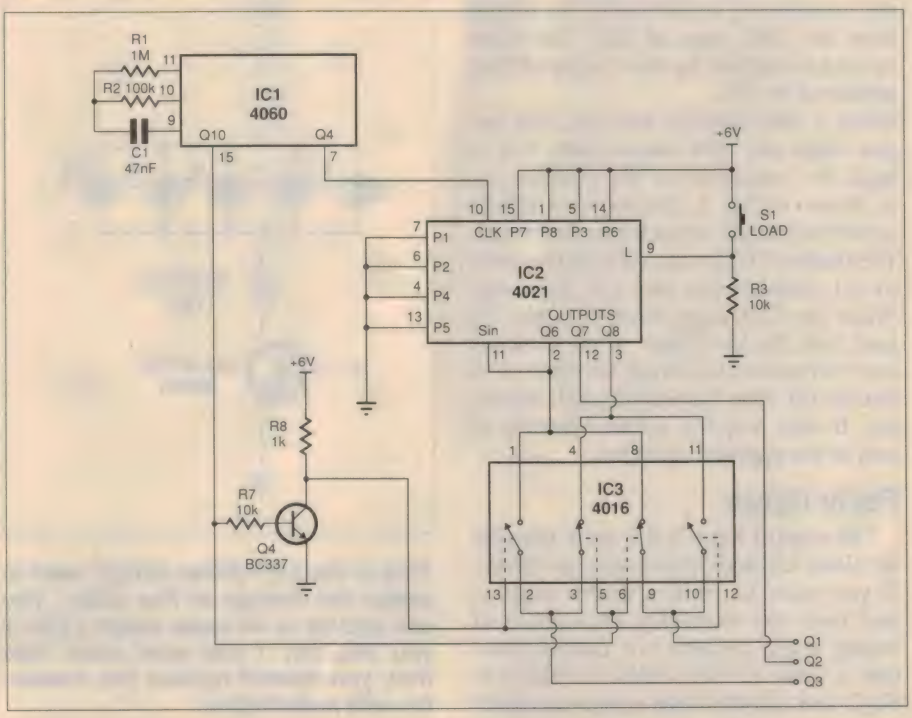
L L H L L H X X

Here L= low (0V) H = high (6V) and X = don't care because the contents of registers 7 and 8 get shifted out and lost on the first two clock pulses. To make the wiring as simple as possible, inputs 7 and 8 have been taken high. The contents of registers 1 to 5 are not available as outputs so the action at each shift is:

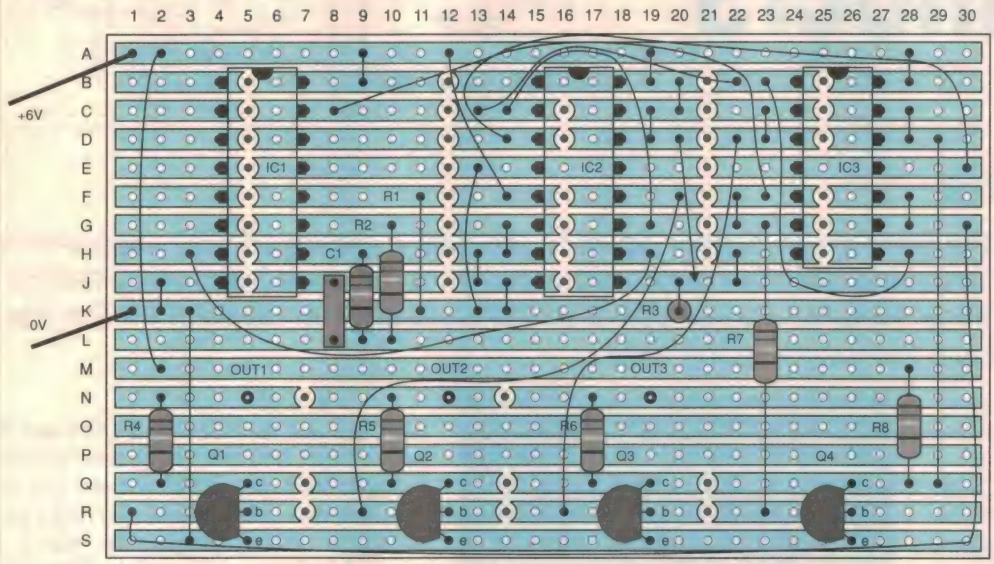
Not available					Outputs		
1	2	3	4	5	6	7	8
L	L	H	L	L	H	H	H
H	L	L	H	L	L	H	H
L	H	L	L	H	L	L	H
L	L	H	L	L	H	L	L
H	L	L	H	L	L	H	L
L	H	L	L	H	L	L	H

and so on. At each stage, the input waiting to be loaded into register 1 on the next clock pulse is equal to the present contents of register 6.

Ignoring the two incorrect initial states,



At right is the schematic for the logic that controls the lights. Above is the Spinning Lights display with the circuit board flipped out into view.



As you can see, there are a few jumpers on this board so use insulated wire to prevent shorts. The strings of LEDs connect to the three pins labeled OUT1, 2 and 3 on row 'N', just above each transistor.

the outputs go high in succession, repeating every third clock pulse. The output of register 7 goes directly to a transistor Q2, which turns on a bank of five LEDs. The outputs of registers 6 and 8 are passed through IC3, which is a CMOS switch, connected to act as a double-pole double-throw switch.

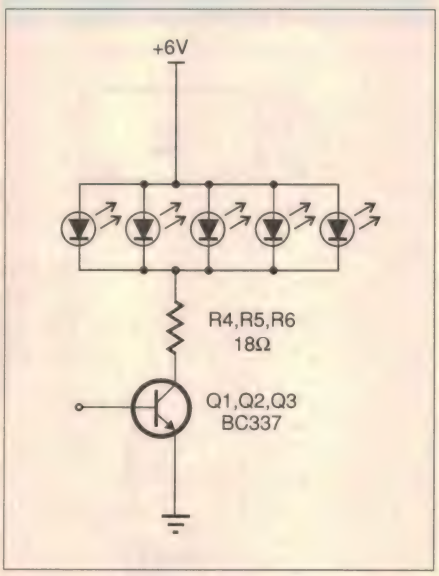
The four switches in IC3 are actually the equivalent of single-pole single-throw switches, each with a control input (dashed lines). The switch is closed when the control input is high. Two of the switches are controlled by the output from the 10th stage of IC1. The other two are controlled by the inverse of this, produced by Q4.

Work it out carefully and you will see that when the Q10 output from IC1 is high, the 'positions' of the switches are as drawn in Fig 1. Output 6 of IC2 is routed to Q1 and output 8 is routed to Q3. The banks of LEDs are switched in order by Q1, then Q2 and then Q3, repeating. When the Q10 output from IC1 (pin 15) goes low, the 'positions' of the switches are reversed and LEDs are switched on in turn by Q3, then Q2 and then Q1, repeating. In this way the spinner appears to turn in the opposite direction.

Party lights

The control logic is the same whether we flash LEDs or mains-voltage lamps. If you want to build a macro display, and have the necessary experience of wiring mains circuits, you could substitute a relay for the banks of LEDs in Fig.2 and use the three relays to switch three banks of mains-powered lamps — perhaps three sets of party lights mounted so that the lamps of each set run in order 1, 2, 3 along the supporting beams of the house.

If you want to stick with LEDs, however, note that we have limited the number of LEDs to five because this is the most we can afford for $10. If expense is no object, you can have 12 or more LEDs in each bank. In this case it would be better to use a Darlington transistor so that the relatively large current (up to 500mA with an MPSA14 Darlington) can be switched by the relatively small current available from the CMOS outputs. Connect a 10k resistor between each CMOS output and the base of the transistor.



This is the LED driver circuit used to power the strings of five LEDs. You can add up to an extra seven LEDs if you like, but if you want more than that, you should replace the transistor with a darlington.

If you switch large numbers of LEDs it may happen that spikes on the power lines will upset the action of the divider and the shift register. If you find the circuit acting erratically, try wiring a 1000uF electrolytic capacitor between the 6V line (at the point where the display is connected) and the 0V line. Alternatively (or as well) wire a 0.1uF green-cap or MKT across the +6V and 0V terminals of IC1 and/or IC2.

Construction

The project runs on 6V DC and takes about 50mA. Since it is likely to be running for several hours at a time, the best power source is a mains plug-pack, one of the smaller sort supplying 6V DC up to 300mA. Or you could use a 6V lantern battery or four D-type cells in a battery box.

We have made the board fairly compact so that it can be hidden inside the base. Note the cuts beneath the board and especially the points under the ICs where the strip is *not* cut. We have made plenty of use of solder-blobs beneath the board or you can use links instead. First assemble IC1, with R1, R2 and C1. Test clock operation with a meter at pins 7 (about 6Hz) and 15 (about 0.1Hz). Now

install IC2 and IC3, with Q4, R7 and R8.

Note the simple switch (S1) used for loading IC2. Pin 9 of IC2 is held at 0V by R3. This is mounted vertically with the bare lead wire toward the top of the board. A stiff piece of wire, soldered in the +6V rail at D20, projects from the board so that its end is close to R3 but not touching. Call this the flying contact.

When you switch on power, the registers all hold 0V so there is no apparent action. Press the end of the flying contact briefly against R3. This loads the registers and, when you release the pressure so that the flying lead springs away, the shifting action can be monitored with a test meter. Monitor outputs at pin 12 of IC2 and pins 2 and 9 of IC2.

You will not be able to check the sequencing exactly but, if the outputs are swinging high and low regularly at about 2Hz, all is probably well. Incidentally, if you fit a 0.1uF capacitor between the positive rail and pin 9 of IC2, the circuit will self-load every time the power is applied.

Now complete the circuit by assembling the transistor switches and wiring up the LEDs. For the base of our prototype we used one of those plastic snap-on 'lids' that come with certain brands of home-brew beer or wine kits. Otherwise, use any suitable plastic box or make one from thin card.

On the front of the base mark out two concentric circles 62.5mm and 65mm in diameter. Draw radii across the circles, spaced 24° apart. Where the radii cut the circles, pierce holes with a pin or needle. Better, if you have a mini-drill, use a 0.8mm bit and avoid the risk of cracking the base. Push the LEDs through the holes from the front, the anode (a) wires through the outer circle and the cathode wires (k) through the inner circle. A LED's anode lead is usually slightly longer than its cathode, and as well most (but not all) makes of LED have a 'flat' on the rim on the cathode side, so these flats must face to the centre of the circle.

Working on the back of the panel (Fig.4), connect all the anode wires to a single length of stripped single-core wire, working from D1 round to D15. Each anode lead is cut short (about 10-15mm) and bent over the +6V wire running around the base. Connecting the cathode wires is a bit more complicated — we used stripped wire and threaded short lengths of plastic sleeving between each soldered connection, but you could use short lengths of insulated hookup wire instead.

Once the LEDs have been wired up and connected back to the circuit board, switch on the power, load IC2 (if you didn't use the extra capacitor), and the spinning should begin.

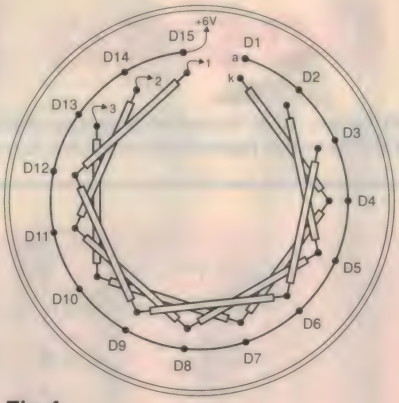


Fig.4

Here's how to wire the LEDs under the stand. Note that every third LED is joined, with all the anodes connected to the positive rail.

If all is well, mount the circuit board inside the base. It can be fixed to the nest of sleeving using Blutack. As a precaution against short-circuits, first cut out a rectangle of thin card the same size as the circuit board and fix this to the copper-strip side of the board using pieces of double-sided adhesive foam.

When we began this project we had ideas for decorating the base with glitter and coloured tinsel and perhaps crumpled aluminium kitchen foil. But in the end we decided we liked it 'plain and simple' and that is how it is.

Ever thought of mounting the LEDs on top of a birthday cake? Could look just like a UFO! ❖

PARTS LIST

Resistors

(all 0.25W, 5% tolerance)

R1	1M
R2	100k
R3, R7	10k
R4-R6	18 ohm
R8	1k

Capacitors

C1	47nF, 50V ceramic

Semiconductors

D1-D15	light-emitting diodes
IC1	4060 12-stage oscillator/divider
IC2	4021 eight-stage shift register
IC3	4016 quad bilateral switch
Q1-Q4	BC337 NPN transistor

Miscellaneous

Stripboard 48mm x 78mm (18 strips x 30 holes); 5 x 1mm terminal pins; 2 x 16-pin IC sockets; 14-pin IC socket.

Circuit & Design Ideas

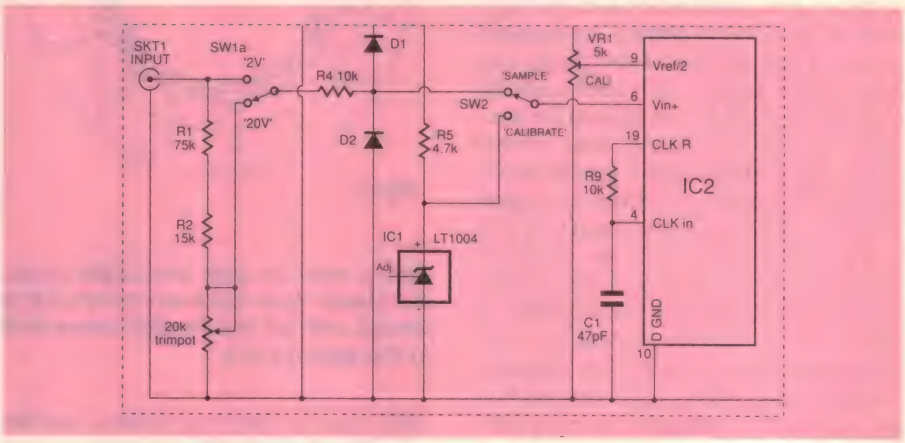
Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

Voltage reference mod for Pocket Sampler

We recently found that the Pocket Sampler (*EA*, August 1996) worked well on two of our computers, but gave readings that varied by as much as 15 bits on another. This translates to around 100 - 200mV, and was unacceptable. After a bit of checking with a CRO, we found that the 5V supply obtained from the printer port was wobbling badly, and hence the reference for the ADC was in turn moving around, resulting in the wild readings.

To overcome this, and to give users more accurate readings I would like to suggest the following changes that can be made to the original circuit.

Firstly, connect the Vref/2 pin directly to an LT1004 voltage reference. This has a reference voltage of 1.235V +/- 4mV. It's a bit more expensive than the LM336, but is more accurate and the ADC is so much more stable. OK, the voltage is a bit funny and not as nice as 1V, but I can now connect my pocket sampler to any PC around and get readings accurate to 1 bit, and don't have to adjust the trimpot every time I change to a different computer.



The second alteration is to replace the 10k resistor in the 20V input divider with a 20k trimpot. The old 10k resistor is removed, and the pot is inserted in its place. This allows the user to have accurate 20V readings, whereas before the readings could be up to 3% inaccurate.

Peter Simmonds
Balnarrang, Vic. **$35**

(Note that the above modification will produce data that will need to be scaled before use, as the full scale value will be 2.47V rather than the original 2.00V. This scaling can be done in whatever application you are using the data in, but we can supply a modified POCKET.EXE that scales the data before it is saved to disk. If you are interested, just send us a formatted floppy with $5.00 P+P, and we'll send you the modified version. — Graham Cattley)

Pump controller for solar water heater

Recently, I became involved in raising tadpoles. When I first moved to Queensland we had many frogs in the area, but the numbers have dropped over the last 10 years due to the introduced South American Gambusia fish, which has wiped out many species of frog, even before many of the species were identified.

I have both the green tree frog, and the beautiful brown and black striped 'poppers' or salty marsh frogs, but the trouble is that they tend to winter over (they suspend turning into frogs) if the water temperature drops below 20°. This is is particularly so if food and water is plentiful, and so to encourage them to develop (and thus not get eaten when released) I built a solar heater with a pump to maintain the water temperature during the winter months.

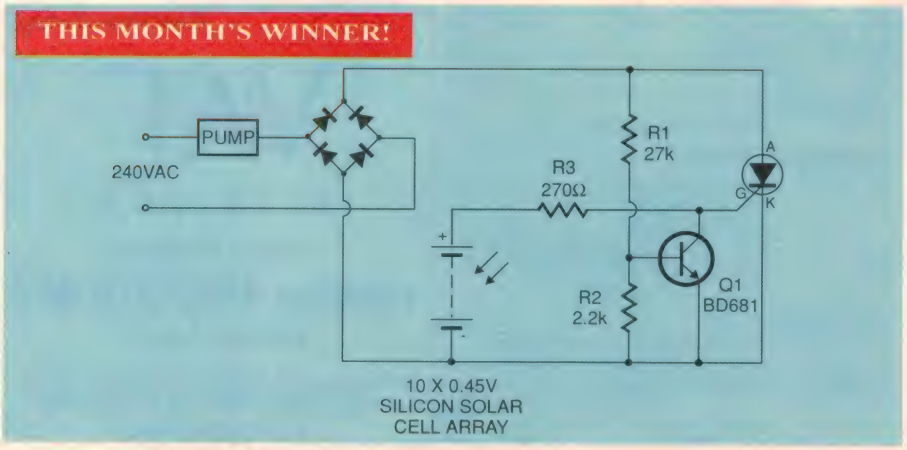
This, unfortunately meant that I had to be there every morning and evening to turn the pump on and off. I really needed something that would turn the pump on in full sun or light overcast, when the heater is working at its best, and off the rest of the time. (The idea is to not cook the tadpoles...)

I designed a circuit a number of years ago to control electric blankets, crystal ovens and the like, and so I modified it to only operate in sunlight. I tried using LDRs, but I found them to unstable in this application. Instead I used a small solar cell array out of a Dick Smith rechargeable torch to trigger the SCR; but the addition of Q1 means that the SCR will only trigger at the zero crossing point, and so won't cause interference.

I hope this circuit is of use to other readers, especially frog lovers.

Chez & Janina Watts
Bracken Ridge, Qld. **$35**

THIS MONTH'S WINNER!



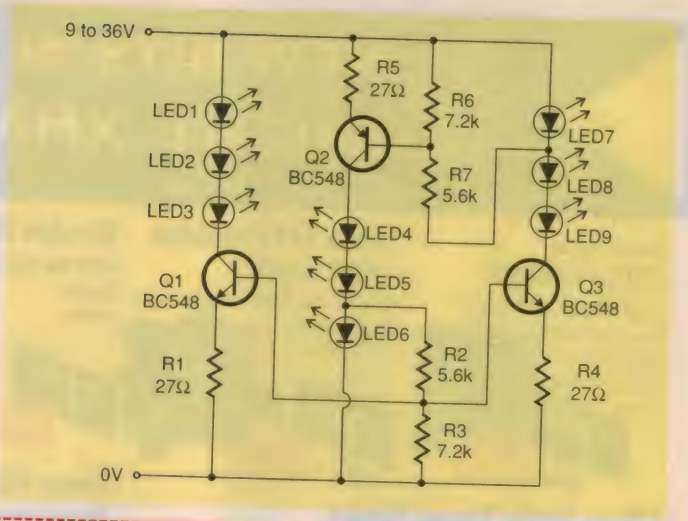
LED light supports wide supply range

The following circuit provides low-level illumination by means of nine high intensity LEDs. It can be powered by a 9V battery which should last a couple of hours, but its main claim to fame is that it can run off a higher DC voltage, up to a maximum of about 36V.

It consists of three strings of three LEDs, with LED1-3 driven by a constant current sink consisting of Q1 and R1-3. LEDs 4-6 have Q2 driving them as a constant current source, while the third string operates in the same way as the first. The two voltage references needed by the constant current generators are tapped off from the voltage drop across LEDs 6 and 7 with resistive dividers.

All up the circuit draws 48mA, and would be useful is situations where a stable supply isn't available.

Wayne Robjent
Perth, WA **$25**



Divider gives 1:1 output

The usual way of dividing the frequency of a square wave by 10 is with a BCD counter, using the input frequency as the clock signal and taking the output frequency from the Q3 (8) output. This output signal is a rectangular wave with a mark/space ratio of 1:4, but what if you want a square wave output (mark/space ratio of 1:1), or you want a divide by five output as well?

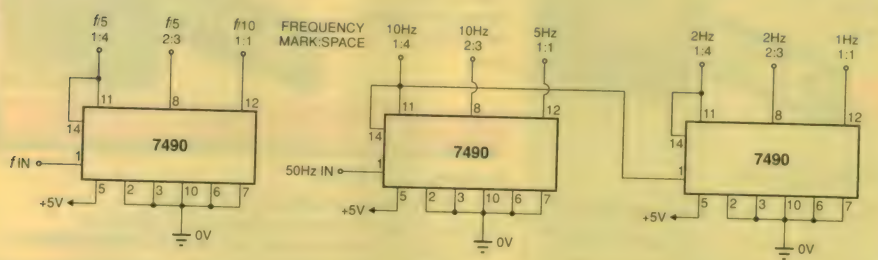
Well, here's a simple circuit which, using only one IC, takes an input signal with any mark/space ratio and produces a 1:1 square wave output at 1/10 of the input frequency — and has a divide by five output as well. It uses a 7490 mod-2 and mod-5 counter IC 'backwards', so to speak. Normally, the input signal is used to clock the mod-2 counter and its output used to clock the mod-5 counter, forming an ordinary BCD counter. However, if the input signal signal is used to clock the mod-5 counter and its Q4 output (pin 11) is used to clock the mod-2 counter, then the output of the mod-2 counter will be a square wave at 1/10 of the input frequency, and will have a mark/space ratio of 1:1.

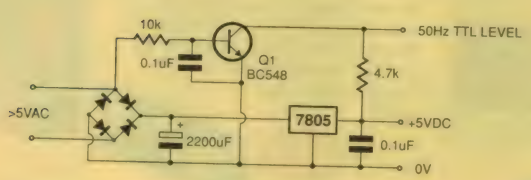
Both the Q2 and Q4 outputs (pin 8 and 11) of the mod-5 counter will produce pulse trains with ratios of 2:3 and 1:4 respectively, and be 72° out of phase.

Two of these circuits could be cascaded to make a symmetrical divide by 50 circuit, with the divide by 5 output clocking the second chip. This could be used to provide a 1Hz square wave from a 50Hz signal derived from the mains. It would also give two 10Hz outputs (with 2:3 and 1:4 mark/space ratios), a 5Hz output (1:1) and two 2Hz outputs at 2:3 and 1:4.

The lower circuit shows how the 50Hz signal can be tapped off from a standard power supply.

Vasantha Crabb
Bellingen, NSW **$25** ❖





WIN OUR 'IDEA OF THE MONTH' PRIZE!

As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a complete closed circuit TV system, comprising a 5" B&W video monitor, CCD video camera with stand, power supply and cabling. This system comes from our sponsor Allthings Sales & Services, and is valued at $369.00!

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*LED not incl.
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Vol 1 Rudolf Graf

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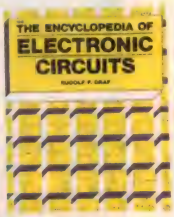

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James Barbarello, 119 pages

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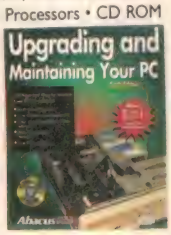

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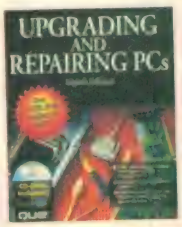

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- Expanded capabilities for switching on and off up to 16 receivers from one transmitter. (Additional receivers required)
- Up to 8 different commands can be sent to each receiver.
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- Supplied with components, PCB, zippy boxes, hardware, IC sockets, front panel labels and mains components for one transmitter and one reciever unit.

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- MTP3055 MOSFET switches the unit on or off when earphones are plugged in or removed.
- Far less expensive than ready-built, commercially available units.
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- Full, realistic control of your model trains.
- One control provides full reverse to full forward speed.
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- Simple and quick project for a model railway layout
- Simulates a set of traffic lights at a cross intersection
- Circuit designed as a free-running oscillator cycling lights through the green, amber and red sequence.
- Power source required: 15 volts DC
- Supplied with components, LEDs and PCB
- Case optional (use H 2851)
- PCB size: 80mm x 95mm

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- Can be used as an rpm indicator for electric motors, car engines, electric mixers, or anything that moves or rotates.
- Range adjustable from 400 to 4000 rpm.
- Wide/Narrow switch lets you alter width of output pulse to prevent blurring at higher speeds.
- Uses bright white 600mCd LED.
- Power source required: 9 volt battery.
- Supplied with components, hardware, PCB, case and front panel label.
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Availability: Our kits consist of many different parts from numerous suppliers. Whilst we have consulted closely with them and are satisfied as to their ability to supply, sometimes problems can arise in obtaining all of the parts. This means there is a slight chance that availability may be delayed. Rainchecks are available, however if you'd like to check beforehand, please don't hesitate to contact your local store.

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Range
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Channel A: 10-1000MHz (3 - 50mV RMS)
1-1.25GHz (10 - 150mV RMS)
Channel B: 10Hz-1MHz (15mV RMS) 1MHz-5MHz (20mV), 5MHz-10MHz (40mV)
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Q 1322

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You can rely on this 9-digit universal counter for quick and accurate measurement of a wide range of frequencies. Packed with unique features, it has the precision and specifications for top performance, plus its high resolution and fast response time make it a must for the workshop.

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- Crystal locked time base.
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- Maths Function
  - Offset (addition & subtraction)
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Assorted sizes. Sizes include:

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44mm x 1.2mm x 1.2mm
46mm x 1.2mm x 1.2mm
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57mm x 1.2mm x 1.2mm
82.5mm x 1.4mm x 1.4mm
100mm x 1.6mm x 1.6mm
105mm x 1.2mm x 1.2mm
125mm x 1.2mm x 1.2mm

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Comes in packs of 14 assorted sizes.
Sizes include:

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56 x 0.8 x 8.0mm
60 x 1.0mm
70 x 1.0mm
76 x 0.6 6.0mm
83 x 1.6mm
92 x 1.2 10.0mm
97 x 1.2mm
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114 x 1.8mm
121 x 2.3mm
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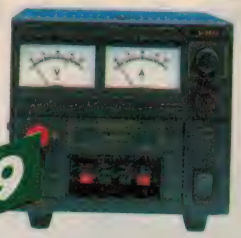

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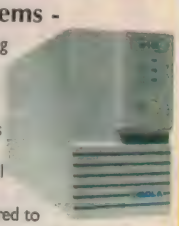

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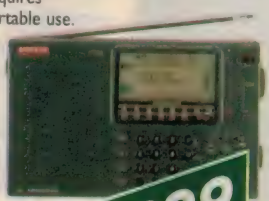

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Construction Project:

AUDIO MASKER FOR TINNITUS SUFFERERS

What's an audio masker, you ask? It's a device that provides a low level background hiss, used to help mask the noises heard by people suffering from tinnitus. The device presented here can be configured to provide a background sound that can range from a strong rushing waterfall down to the soft sound of wind blowing through the trees. It's a lot cheaper than commercial units, and runs off a single 9V battery.

by GRAHAM CATTLEY

Tinnitus is a term used to describe ringing in the ears, or any other form of perceived sound that doesn't come from an external source. Tinnitus can manifest itself as anything from constant low level roaring, through cicada-like chirrups to a high frequency background squeal.

Over 20% of the population will suffer from tinnitus at some point in their lives. For some, it is just an annoyance, while for others it can become a nerve-wracking condition that affects almost every aspect of their lives.

Some relief can be found in the use of 'audio maskers', devices that emit a constant, low level blanket of random noise that makes the tinnitus aesthetically more acceptable. The ear/brain also becomes adapted to the masking and automatically disregards it, and in the process it tends to disregard the tinnitus as well. The use of an audio masker can help significantly when reading, studying, or even just trying to get off to sleep.

Small enough to slip into a pocket, the Audio Masker is designed to be used with a standard pair of earphones and runs off a single 9V battery. A switched tone control lets you adjust the sound to provide the most effective masking.

Perhaps the simplest audio masker would be the hiss of an FM radio tuned off-station, or a recording of environmental sounds like waterfalls, but there are a couple of points in favour of the specifically designed audio masker described here.

Due to the diverse range of sounds heard by tinnitus sufferers, different types of masking signal are often desirable. Maskers are often more effective with people who experience a high pitched tinnitus (usually described as 'ringing'), and each user can benefit by adjusting the level and degree of filtering of the masking noise to be most effective in covering their tinnitus.

There are also the more practical aspects of size, portability and battery life to be considered, along with the all-important factor of price. So with all these points in mind we've come up with what we think is a useful, practical and configurable design that should provide a degree of relief to many users. As well, it costs a lot less than commercial models — some of which can run to over $800 each!

The circuit

The heart of the masker is Q1, an NPN transistor. Here we are taking advantage of the reverse-bias leakage current that will flow through the PN junction between its base and emitter leads. If the voltage drop across these two leads is higher than the junction's reverse breakdown voltage, the transistor will break down and current will flow backwards through it, producing noise. The current flow is limited to less than 100uA by the resistance of the 250k volume control VR1, and so the transistor isn't damaged.

One problem with this approach is that the base-emitter reverse breakdown voltage of most common transistors is between 10 and 15 volts. We wanted to run the masker on a single 9V battery (both for size and cost considerations), so we've employed the services of a voltage doubler circuit based around the CMOS 7555 timer IC1.

IC1 is configured as an astable multivibrator running at around 60kHz, with a roughly even mark/space ratio. This drives the voltage doubling circuit itself, comprising D1, D2, C1 and C2. When running, the junction of D2 and C3 should rise to around double the battery voltage, so a fresh 9V battery should deliver approximately 18V to the emitter of Q1.

With this high voltage applied, the transistor breaks down, and the resulting noise signal is developed across the volume control RV1. The signal is then tapped off via the 10nF capacitor C4, and passed directly to the signal input of IC2, an

LM386 audio amplifier IC.

Due to the 50k input impedance of the 386, capacitors C5 and C6 allow you to provide a degree of filtering to the noise, tailoring the tone to best suit the listener. The values shown in the circuit are just examples of the sort of values to try, but any value up to 1uF will work, with the higher values filtering out more and more of the higher frequencies. SW1 lets you switch between two different capacitors, or just use one capacitor and leave the other position disconnected, letting you switch between filtered and unfiltered noise.

The audio amplifier is pretty straightforward, with C7 and C8 helping to bypass the IC's supply. It's worth mentioning the role of R3 at this stage, as you may need to change its value depending on the degree of filtering you have decided on. R3 is connected in series with 10uF capacitor C9 between pins 1 and 8 of IC2. These two components set the gain of the amplifier, which with the values shown will give a gain of 20.

If you decide on heavier filtering for the input signal, to give a less harsh sound, you'll notice that the output volume will drop (because you've attenuated the input). To compensate for this you can increase the amplifier's gain by *decreasing* the value of R3.

Dropping R3 down to a value of 470Ω will give a decent boost to the signal. You can even replace R3 with a wire link to give the maximum gain of 200, but this will tend to drain the battery at a higher rate. As it stands the circuit draws around 5-6mA when running, but this will increase to 15-20mA at the highest gain setting.

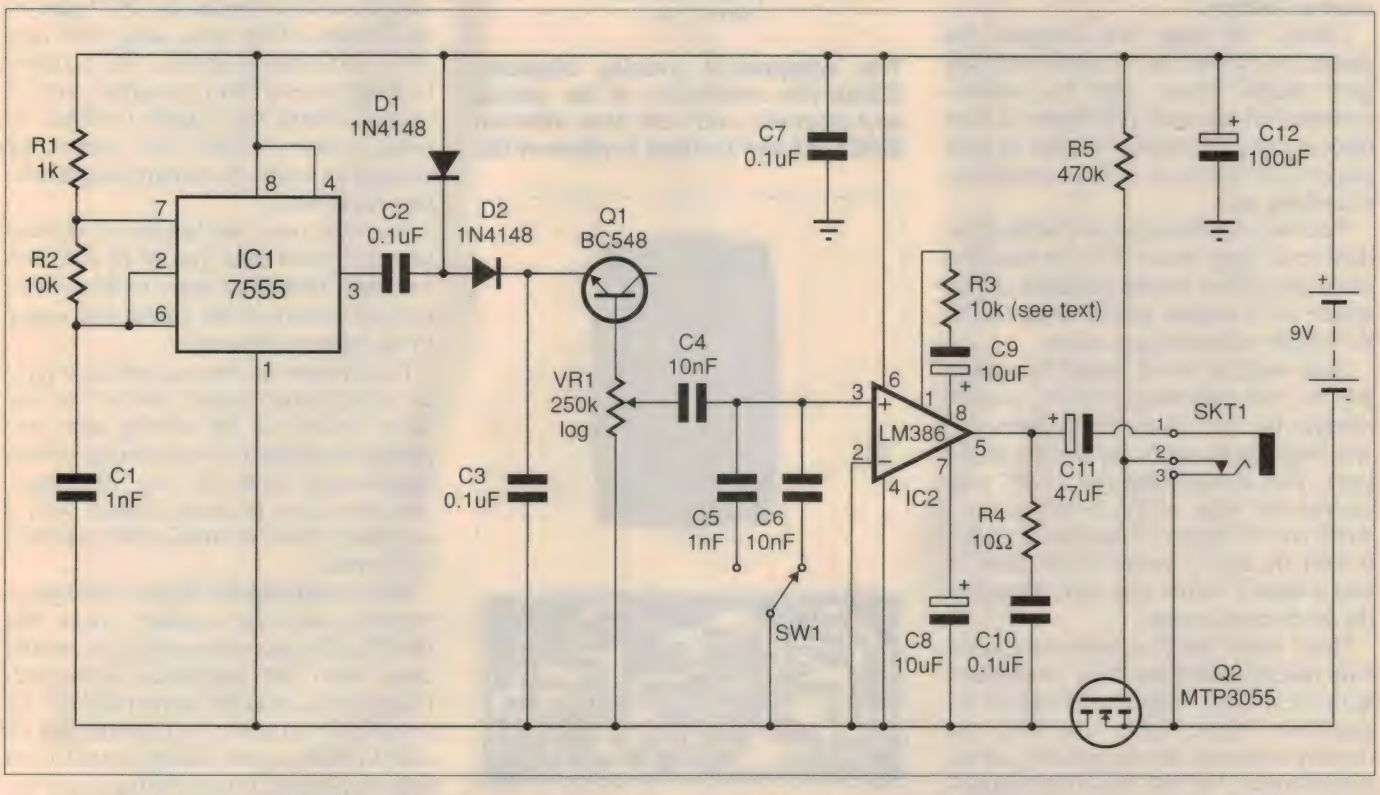
You can see here how the pot's lugs are trimmed off so that they won't hit the side of the case. The PCB is mounted to the bottom of the case by two short self tappers, and the battery sits on edge beside it.

No off switch?

If you look closely at the photos, you'll notice that the masker doesn't have an on/off switch. This was done for a couple of reasons: firstly there wasn't any room on the front panel for another switch, and secondly there's always a chance of these small projects being accidentally left on after use, draining the batteries. We could have had a small pilot LED to let you know that the unit was on, but we found that the LED drew three times as much current as the rest of the circuit put together!

Instead, we are using an MTP3055 power MOSFET to switch the circuit on only when the headphones are plugged in, and to switch it off when they are removed.

With the headphones removed, the



IC1 drives a voltage doubling circuit, which supplies 10-18 volts to Q1. IC2 amplifies the noise produced, while Q2 switches everything off when the headphones are removed.

Audio Masker For Tinnitus Sufferers

MOSFET is held off due to its gate and drain being shorted together via the switched contacts inside SKT1. Once the headphone plug is inserted, however, the socket's switched contact (labeled 2 in the schematic diagram) is isolated, and the MOSFET's gate is pulled high via 470k resistor R5. The MOSFET then turns on, and supplies current to the rest of the circuit.

When unplugged (off), the circuit draws around 17uA, by virtue of the DC path via R5 and SKT1. This is well within the self-discharge characteristics of the 9V battery, so despite this small drain you'll still get the maximum life out of your battery.

Note that we're only supplying a maximum of 20mA in this circuit, and so any of the smaller power N-channel MOSFETs could be used instead of the MTP3055 — such as the common VN10KM, which is supplied in a modified TO-92 case. We only used the larger TO-220 style because they were slightly cheaper and more readily available.

Construction

Construction of the audio masker isn't particularly difficult, but due to the somewhat cramped conditions inside the case you might find it easier to proceed as follows.

Firstly, the case. We designed the masker to fit into one of the newer light grey plastic boxes, with the controls mounted on one end. This makes it very easy to carry the masker around in your pocket and results in quite a professional looking unit.

You can, of course, use one of the standard small zippy boxes (they're much the same price). But for the purposes of this article we'll assume you're using one of the slightly slimmer grey cases.

Start work on the PC board by enlarging the two mounting holes to accommodate the two short self-tappers that will hold the board to the bottom of the case. This done, insert the 11 PC pins around the edge of the board, using a small pair of pliers. These pins are often a tight fit, so it's easier to get them in and soldered before you start mounting the other components.

Next, install the five resistors and the two diodes, checking their orientation with the overlay diagram. Install all the capacitors next, again checking the overlay diagram for the polarity of the electrolytics. For the two filter capacitors C5 and C6, we suggest that you go with the values as described for now, as you can easily alter their value once everything is up and running.

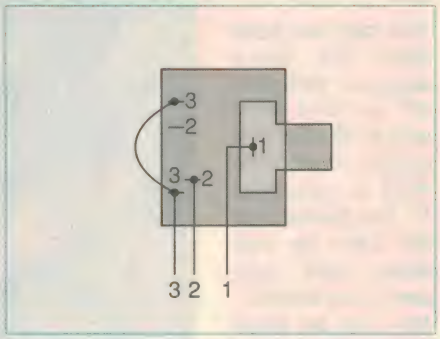
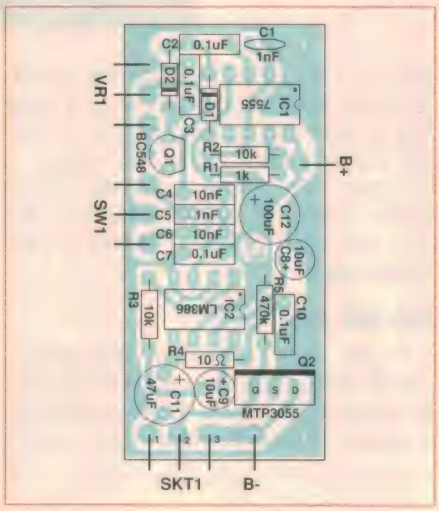
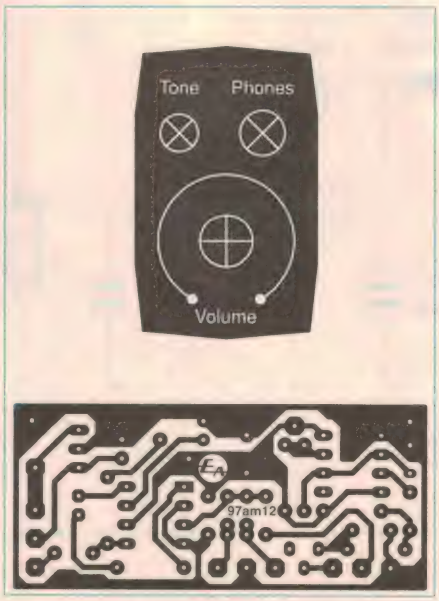


Fig.2: Above are the connections to a common stereo socket, with both channels wired in parallel.



The component overlay diagram. Watch the orientation of the diodes and electros, and note that different MOSFETs can be used in place of Q2.



Here's the board pattern and front panel artwork reproduced full size.

The last things to go on the board are the two ICs, the transistor and the MOSFET. Solder these in, taking care of the 7555 and the MOSFET as these are static sensitive devices.

With the PC board now finished, you can start on the front panel. Using a photocopy of the artwork as a guide, mark off and drill the three holes for the pot, switch and socket. Then if you are using an adhesive front panel, stick it on and cut out the holes with a sharp knife.

The pot can be mounted first, with its shaft trimmed to length to suit the knob, and its three terminals facing the edge of the panel as shown in the photo. Mount the switch and socket in their respective holes, and check that the populated panel will fit in the case. It probably won't first time round, as the pot's terminal lugs tend to foul against the edge of the case. If you do as we did and trim them off short with a pair of wire cutters, a bit of luck and fine tuning should make it all fit.

In some cases the back of the pot may hit against one of the support pillars, and you may have to enlarge the pot's mounting hole in the panel to let the pot sit as far forward as possible.

With the panel in place you should now be able to mount the PC board in the bottom of the case using two *very short* self-tapping screws. We couldn't find any screws short enough to suit the case's 2-3mm high support pillars, so using a pair of (old!) side cutters we clipped a couple of standard length self-tappers to size...

You can now run lengths of hookup wire (we used short pieces of IDC ribbon cable) from the board to the switch, pot and socket on the panel, and solder in the battery clip leads.

Fig.2 shows the connections to a typical stereo phono socket, and as you may have noticed we are driving both earphones in parallel. If your socket differs significantly from the one illustrated, you may have to probe around with a continuity tester or multimeter to identify the pins.

After installing the battery and before screwing the case together, check that the circuit's quiescent current is around 20uA with the earphones unplugged. Plug them in, and the current should rise to around 5 to 6mA; you should also be able to hear a soft rushing sound from both earphones. If not, double check the headphone socket connections as this is the most likely place for errors.

Parts List

Resistors
(All 5% 0.25W)

R1	1k
R2,3	10k
R4	10 ohms
R5	470k
VR1	250k 16mm log pot

Capacitors

C1,5	1nF disc ceramic
C2,3, 7,10	0.1uF MKT or polyester
C4,6	10nF MKT or polyester
C8,9	10uF 16VW RB electrolytic
C11	.47uF 16VW RB electrolytic
C12	100uF 16VW RB electrolytic

Semiconductors

IC1	7555 CMOS timer IC
IC2	LM386 audio amplifier IC
Q1	BC548 or equiv. NPN transistor
Q2	MTP3055, BUZ71A/VN10KM or equiv. N-Ch MOSFET
D1,2	1N4148 small signal diodes

Miscellaneous
PCB 55 x 25mm, coded 97am12; plastic box, 90 x 50 x 32mm or similar; SPDT mini toggle switch; 3.5mm switched stereo phono socket; 12mm knob to suit; 9V battery clip; hookup wire, solder etc.

Custom sound

As I mentioned before, the tone of the masker's noise can be altered be selecting different values for the two filter capacitors C5 and C6. Perhaps the easiest way to find the right value is to remove one of the two capacitors from the PC board, and to try tack soldering different value capacitors to the copper side of the PCB. Once you find the value that gives the most effective tone, you can then solder it in place permanently.

Remember that if the volume gets too low (due to using larger filter capacitors), you can increase the gain of the audio amplifier by reducing the value of R3.

If you like, you can use the masker to drive a larger speaker (in a suitable enclosure) and make a tabletop unit. Instead of headphones you could alternatively use a pillow speaker, if the masker is mainly used to help you get off to sleep.

However you use it, I would hope that it affords at least some relief from tinnitus. Please remember though that it is not a cure, and that at best it can only give some symptomatic relief; if you suffer from tinnitus then there *are* things that can be done. Speak to your GP about it, or get in touch with a tinnitus support group.

If you have access to the Internet, you'll find that there are lots of tinnitus information resources available there as well. ❖

Construction Project:

VIDEO & PULSE DISTRIBUTION AMP

There's often a need to distribute composite video or S-Video signals, or frequency/time reference signals, to a number of locations — around a lab, lecture hall or classroom for example. Here's a low cost, wideband buffer/distribution amplifier module that can be used for this purpose. Its very wide bandwidth should also make it useful for driving multiple computer monitors from a single video graphics adaptor.

by JIM ROWE

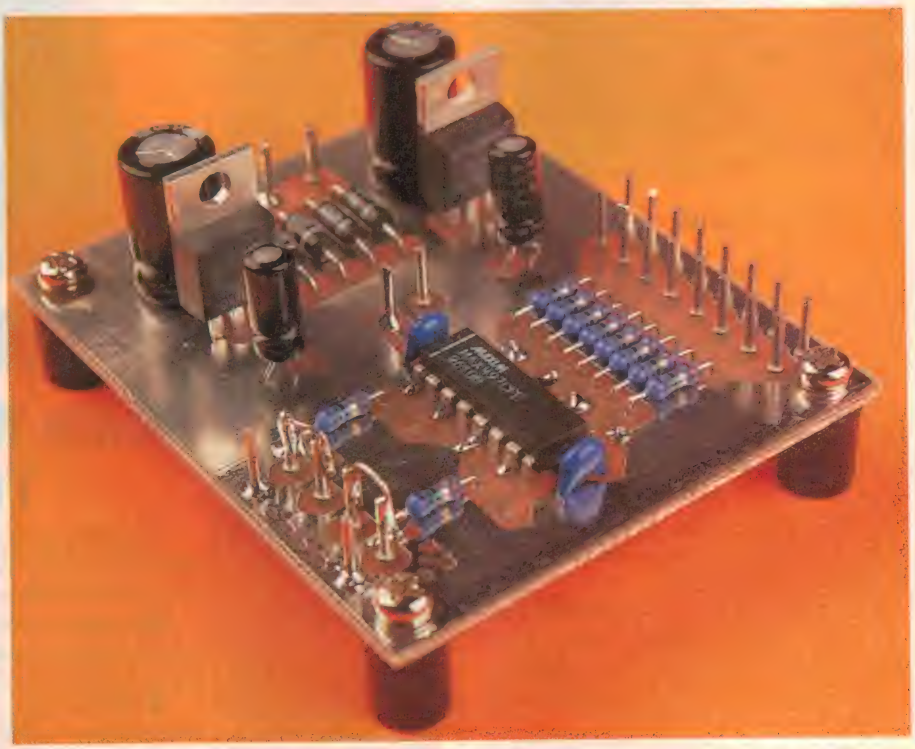
Distributing video and other wideband signals to a number of locations around a lab or lecture hall generally requires the use of correctly terminated coaxial cable runs, if the signals are not to be significantly degraded. And in order to drive a set of correctly terminated cables, you really need a wideband 'distribution amplifier' with the appropriate bandwidth and other performance parameters — like output slew rate, current drive capability and so on.

The small wideband amplifier module described here has been designed for this kind of application. It provides four separate buffer amplifier channels, whose inputs can be linked together in various combinations if desired, to provide a number of different signal splitting combinations: one input to eight outputs, two inputs to four outputs each, or four inputs to two outputs each.

It's also quite easy to wire up additional 'slave' modules, operating from the first module's power supplies, to expand its capabilities further. One slave module will double the number of buffers and allow driving up to 16 total loads, for example.

The bandwidth of each buffer amp channel is essentially flat to well over 100MHz, with an output settling time of 12ns (0.1%), a slew rate of around 1500V/us and the ability to drive either 75Ω or 50Ω back-terminated cables. The amplifiers also have the ability to handle an input voltage swing of at least +/-1.4V, with a distortion of typically around 0.13% (-58dBc).

This performance makes the module excellent for distributing both composite and S-Video (Y/C) analog video signals, and also time and frequency reference signals. In fact the bandwidth is so good that it should also be quite suitable for distributing the component video/separate sync signals from a computer video graphics adaptor — to allow driving multiple monitors from a single PC.



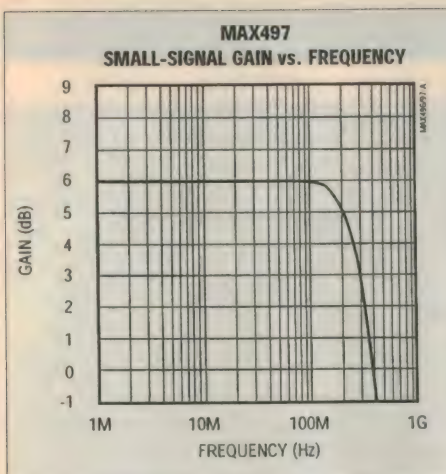
The distribution amp module, shown here slightly larger than actual size. With four separate buffer channels, it can be configured for many different applications.

And the good news is that the module uses only a small number of parts and should be quite easy to build, for a surprisingly low cost.

Impressive chip

The secret of the module's excellent performance is a very impressive wideband buffer amp chip from Maxim Integrated Products, the MAX497. This device consists of four closed-loop buffer amplifiers, each with a voltage gain of two and the kind of performance we could only dream about a few years ago. As you can see from Fig.1, its buffers have a rated frequency response for small signals of about 275MHz (-3dB), and the response is still rated to extend to around 215MHz at full power output.

Each buffer amp inside the MAX497 offers a typical input impedance of 1MΩ shunted by 2pF, an output impedance of only 1.5Ω at 10MHz, an output slew rate of better than 1100V/us for a 4V step and an output THD (total harmonic distortion) of better that -58dBc for a 2Vp-p



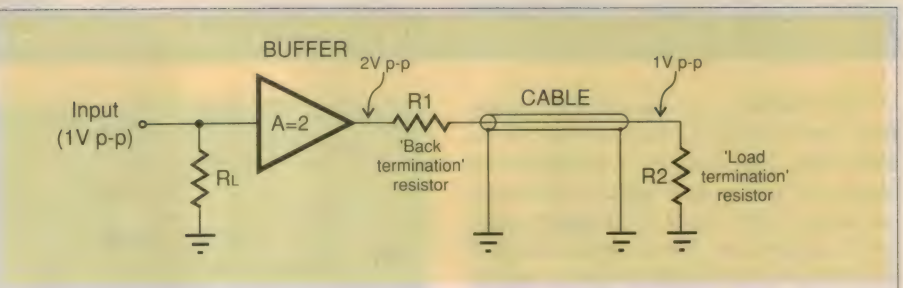


Fig.2 (above): The MAX497 is ideally suited for driving back-terminated coaxial cables, as its buffers have a feedback-stabilised gain of 2.0 (+6dB). This compensates for the voltage divider action of the back and load termination resistors (R1 and R2).

Fig.1 (left): The small-signal response of the MAX497 buffers, taken from Maxim data. As you can see, they're very impressive.

output swing at 10MHz. The overall device also offers adjacent-channel crosstalk of better than -72dB, 'all hostile' crosstalk of better than -65dB, and differential gain/phase errors of less than 0.01%. It's a very impressive device.

Why a gain of two? Simply because the MAX297 is designed specifically for driving 'back terminated' coaxial cables — where the source end of the cable is presented with its matching impedance as well as the load end. This is done by using a series resistor, of either 75Ω or 50Ω as appropriate for the cable concerned. However this in turn means that a 2:1 voltage divider will be formed by the back termination resistor R1 and the load termination resistor R2 at the end of the cable. So by giving the buffer amp a gain of two, we restore the overall gain to unity and ensure that each load receives a full-amplitude replica of the input signal (Fig.2).

The MAX497 should be available either ex-stock or on order from Maxim device stockists. Maxim products are distributed in Australia by Veltek Australia, which is based in Victoria but has offices in most states. The head office number is (03) 9472 3855.

Circuit details

Electrically the distribution amp module is very straightforward, consisting as you can see (Fig.3) of four identical channels based on the simple arrangement of Fig.2. Each of the MAX497 buffer amp inputs has provision for its own matching resistor (R1-R4), while each output is fitted with a pair of back-terminating resistors (R5-R6, R7-R8 etc), to allow it to drive up to two loads. All of the terminating resistors R1-R12 can have a value of either 75Ω, to suit the cable impedance used in most composite-video distribution, or 50Ω to suit the type of cable used in most RF and instrumentation systems.

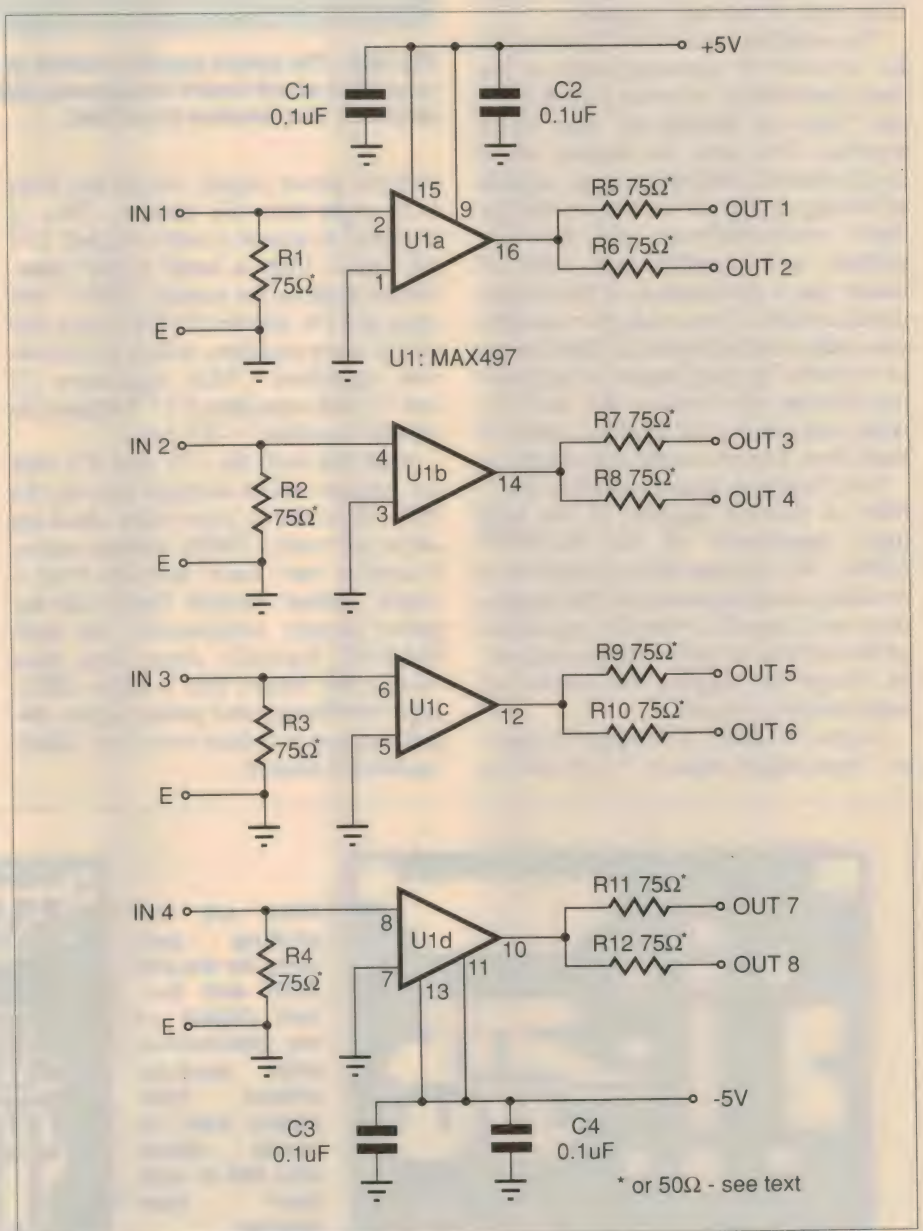


Fig.3(a): The circuit for the signal processing part of the module. With some configurations, some of the buffer inputs are linked together and the redundant termination resistors omitted.

The flexibility of the module stems from the fact that the four buffers can be used either separately or in combination, merely by linking their inputs and leaving out some of the input terminating resistors as appropriate. For example if all four input resistors are fitted and the inputs left unlinked as shown, the module can drive a pair of loads from each of four inputs.

Alternatively by linking inputs 1 and 2, and also 3 and 4, and omitting resistors R2 and R4, buffers 1 and 2 become a 1:4 distribution amp and buffers 3 and 4 do as well. The module therefore becomes capable of driving four loads from each of two input signals.

The remaining main configuration can be achieved by removing three of the input termination resistors (say R1, R3 and R4), and linking all four inputs together. This turns the module into a single-channel distribution amp, capable of driving up to eight loads from a single input source.Although it's probably unlikely to be needed, you could of course use a combination of these main configurations if you wish. For example you could distribute a single video source to six loads by tying inputs 1-3 together and leaving out resistors R1 and R3, while still using U1d to drive a pair of loads from a source connected to input 4.

Note that to a large extent this flexibility is possible because of the high input impedance of the MAX497 buffers. We are thus able to maintain a matching load impedance at the distribution amp input(s), virtually regardless of the number of buffer inputs connected, simply by juggling the number of input resistors we use.

As the MAX497 is designed to operate from supply rails of +/-5V DC, a suitable power supply circuit has been built right into the module. This is designed to accept a centre-tapped 12V AC input, from a small power transformer such as the popular '2851' type rated at 2VA. Diodes D1-D4 form a pair of full-wave rectifiers, which feed reservoir capacitors C5/C6, regulators U2 and U3 and capacitors C7/C8 to provide cleanly regulated +/-5V rails.

Note that both the +5V and -5V rails are brought out to terminal pins on the PCB. This allows convenient checking of the rails with a DMM, and also makes it easy to run 'slave' modules from a single 'master' module fitted with the power supply components. As each MAX497 typically draws less than 40mA, this means that a single 2851-type transformer and power supply circuit can power at least two more 'slave' modules if desired.

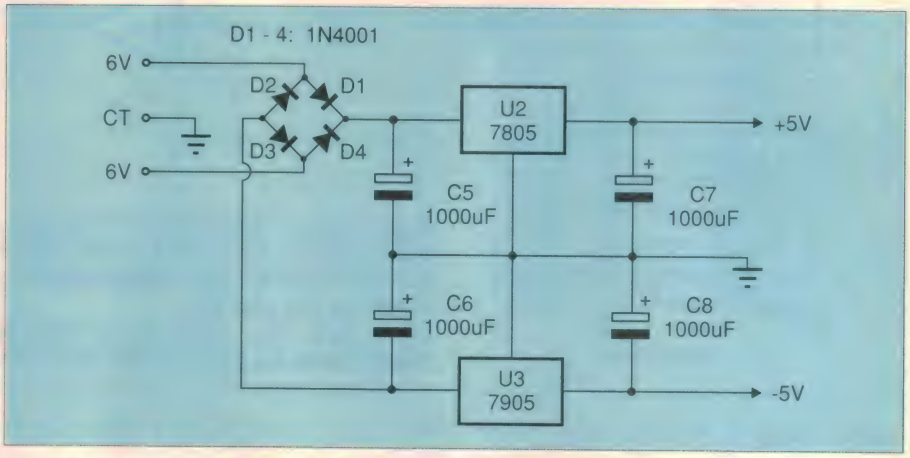
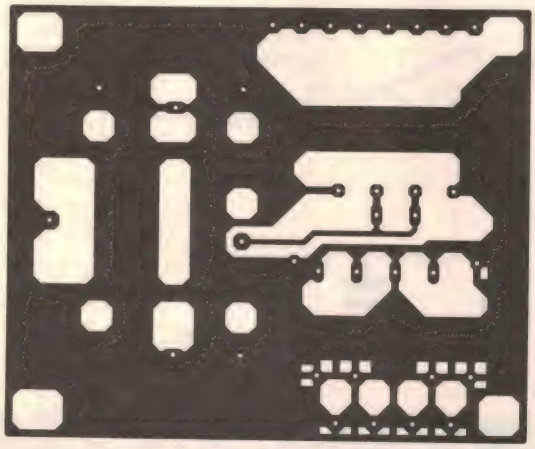


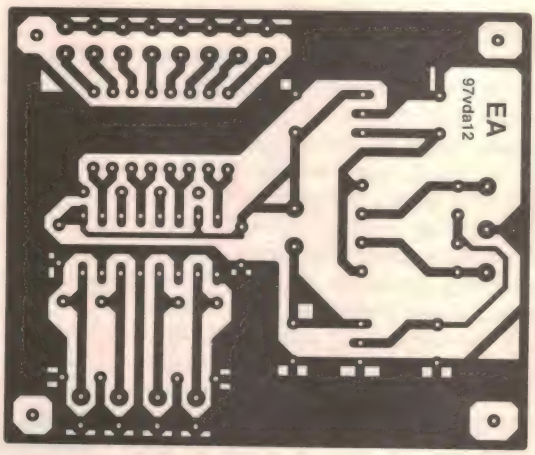
Fig.3(b): The power supply section of the module is very straightforward, and runs from an off-board transformer with a centre-tapped 12V winding. For slave modules, this section is omitted.

The MAX497 is fitted with two supply pins for the +5V rail, and two pins for the -5V rail — both of which have to be well bypassed in order to achieve the chip's full bandwidth potential. That's the purpose of capacitors C1-C4, which are fitted as closely as possible to the pins concerned.

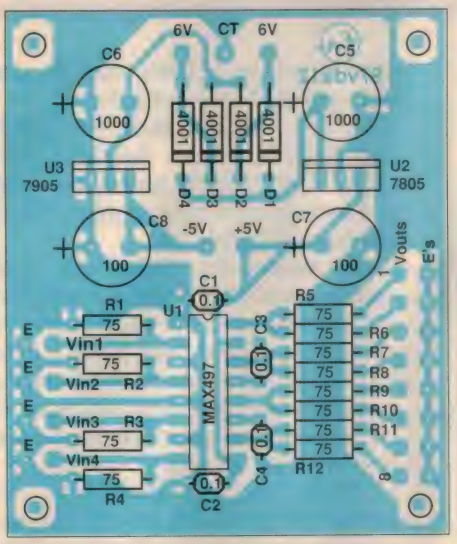
Construction

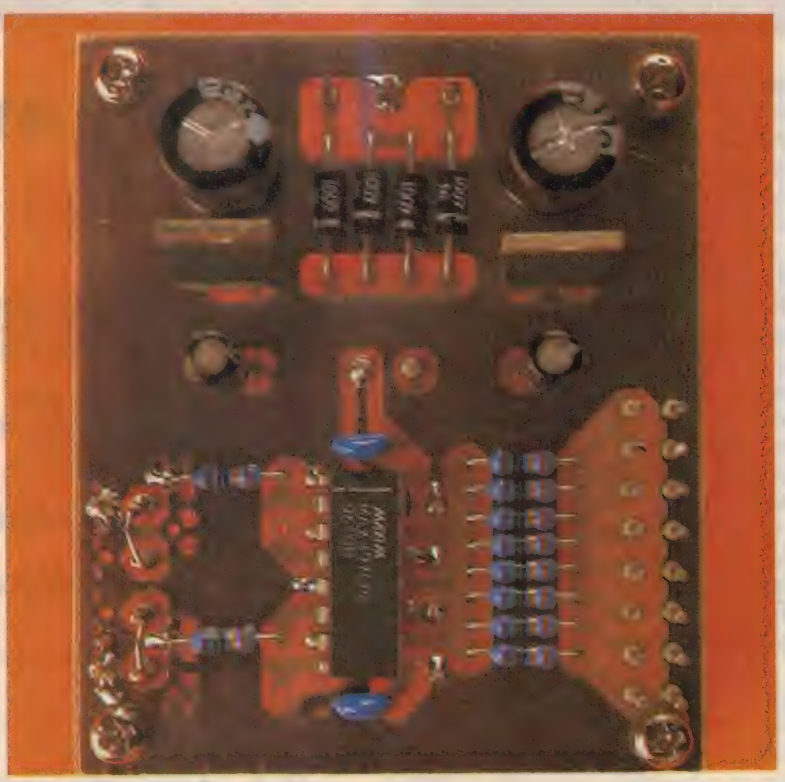
The complete distribution amp module is built on a small printed circuit board measuring 58 x 70mm, and coded 97vda12. The board is double-sided, with the top copper layer used mainly for a ground plane — and also to convey the -5V rail to the appropriate pins on the MAX497. No plated-through holes are required on the board, however, as the only through connections can be made quite easily by solderding both sides of one PCB terminal pin and some





Here are the etching patterns for the top (left) and bottom (right) of the distribution amp module, shown here actual size to assist those who like to etch their own boards.





To assist you with the assembly of the module, here's a top view as well as the PCB overlay diagram. Note that pins 1, 3, 5, 7, 11 and 13 of the MAX497 should be soldered to the copper on both top and bottom of the PCB, as should the '-5V' terminal pin.

of the pins of U1.

To begin assembling the board, I suggest that you start by checking both sides of it for possible bridges or hairline faults in the copper. If all seems well, you can then fit the PCB terminal pins. There are 16 of these for the outputs (eight active pins, eight earth pins), two for the +5V and -5V rail pins near the centre, and three at the top for the AC power input — if you're wiring up a 'master' board. If you're building a 'slave', you'll only need the centre earth pin at the top, along with the two DC rail pins.

How many pins you fit at the inputs really depends on the exact configuration you want for the module, although it's probably easiest if you fit all four 'active' input pins, and at least one earth pin. That way you'll be able to link and connect to the inputs very easily later. Of course if you intend using all four buffers separately, by all means fit all eight input pins — making a total of 29 for a four-channel 'master' board.

Note that all of the earth pins (including the centre supply pin) should be soldered to both the top and bottom copper of the PCB, so they act as feed-through connections to the top ground plane. It's also important to solder both top and bottom of the -5V rail pin in the centre of the board, as this pin transfers the -5V rail to the top layer.

With the pins in place, the other components can be added. I suggest you begin by fitting the output resistors R5 - R12, followed by however many of the input resistors you're going to need for the configuration you'll be using. Note that all of these resistors should be either 75Ω for composite video work, or 50Ω for general distribution of RF/pulse signals.

If you're building a 'master' board, you can now add the power supply components — the four rectifier diodes, the four electrolytic capacitors and finally the two regulators U2 and U4. Make sure you fit the 7805 regulator in the U2 position; transposing the two could be disastrous for both the regulators and the MAX497 chip.

In fact before proceeding further at this stage, you may wish to connect the power input pins temporarily to the secondary of your transformer, apply power and use your DMM to check for +5V and -5V (referred to PCB earth) at the two centre rail pins.

If all seems to be in order, you can then move to the final assembly stage: fitting the MAX497 chip itself, and its four monolithic bypass capacitors C1-C4. Here it's easiest if you fit the chip first — this allows you to solder all of the pins on the underside of the board, and then pins 1, 3, 5, 7, 11 and 13 on the top as well.

The last step is to fit the four monolithics, which should be fitted with the shortest possible lead lengths (i.e., with their body as close to the PCB as you can get, without straining the leads or component). Note here that it's easiest if you fit C1 and C2 from the top in the usual way, soldering them to the underside copper, but conversely fit C3 and C4 from the underside and solder them to the top copper. You can see from the photos that I did this with the prototype shown, and it was both convenient and effective.

Your distribution amp module should now be complete, and ready for use. How you configure it, how many you use and how you house it/them will of course depend on your intended application; that's why I've left those aspects for you to decide. Before ending up, though, there are a couple of specific applications where some further comments might help.

S-Video signals

First, there's the matter of distributing S-Video or 'Y/C' video signals, of the type used by higher-quality VCRs, camcorders and TV receivers/video monitors. As the name suggests, this uses two separate video signals: the luminance or Y signal, which also includes the sync and blanking pulses, and the chrominance or C (colour) signal, which also includes the colour bursts. These are kept separate in the S-Video format, to reduce image degradation caused by colour cross modulation.

Although these signals are thus a little different from the familiar 'composite video', they're still analog in nature,

with much the same bandwidth requirement and distributed at 75Ω impedance.

As a result, the distribution amp just described should be just as suitable for S-Video signals as it is for composite video. All you'll need to bear in mind is that you'll be distributing two signals in parallel.

In other words, you'll be able to use a single module to distribute a pair of Y and C signals to four different S-Video loads — but if you need to drive additional loads, you'll need a slave module. One master module and a slave could therefore drive up to eight S-Video loads, with say the master handling the Y signal distribution, and the slave handling the C signal. (This arrangement would minimise Y/C crosstalk.)

For your reference, the pinouts for the miniature 4/5 pin connector usually fitted to S-Video equipment is shown in Fig.4. As you can see it's quite straightforward. The same connections are used at each end.

VGA signals

The situation is a little more complicated with the analog video signals used by most modern PCs. These generally conform to the 'VGA' or 'S-VGA' format, and one of the problems about this format is that it's not particularly standardised. About all you can say with much certainty at all is that most of them use a 15-pin 'D-sub' connector, with three rows of five staggered pins in the same shell formerly used by the standard DB-9 connector. That's when they don't use a standard DB-15 connector, or a set of three or five BNC connectors!

Even limiting ourselves to the most common D15-sub connector, there's a further complication in that some computer graphics cards and monitors use certain pins of the connector to either tell the adaptor what type of monitor is connected, or allow the two to communicate more extensively. These monitor coding and serial communications systems generally use pins 4, 11 and 12 or pins 12, 15 and 5 respectively.

Let's ignore these fancy 'optional extras', though, as you probably wouldn't be too interested in them if you're simply planning to distribute VGA or SVGA signals to a bunch of monitors around a hall or lecture theatre. For this sort of application, you're really only going to need the main signals used for displaying the video image itself. Luckily this aspect of the D15-sub connection system *is* fairly well standardised, and as shown in Fig.5.

PARTS LIST

Resistors

R1-4	75Ω or 50Ω (or 1k — see text)
R5-12	75Ω or 50Ω (see text)

Capacitors

C1-4	0.1uF monolithic ceramic
C5-6	1000uF 16VW RB electrolytic*
C7-8	100uF 10VW RB electrolytic*

Semiconductors

D1-4	1N4001 silicon diode*
U1	MAX497 quad video buffer IC
U2	7805 +5V regulator*
U3	7905 -5V regulator*

Miscellaneous

PC board, 58 x 70mm, code 97vda12; 29 x PCB terminal pins; 4 x 10mm insulated/tapped pillars.

***Not required for a slave board — see text.**

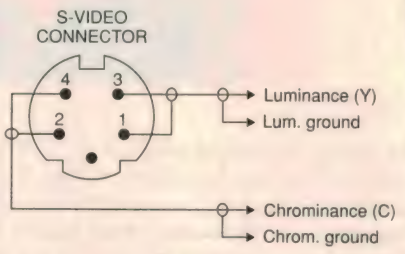


Fig.4: The connections for S-Video connectors. As you can see, there are two separate signals, luminance and chrominance, so you'll need at least two buffers per source.

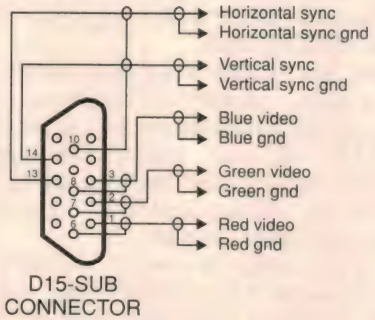


Fig.5: There are five signals present on a computer's VGA/SVGA video output, three of which are wideband analog video. To drive additional monitors you'll need at least five buffers, two with higher-value input resistors (see text).

As you can see, there are actually five main signals — the three colour video signals (red, green and blue), and two separate sync signals (vertical and horizontal sync).

The three video signals are analog, each around 0.7Vp-p and at the standard 75Ω impedance; they're essentially very similar to standard video signals, except that (a) the three colour components are separated, and (b) they can have frequency components which extend much further than standard video (up to 120MHz, in some cases). In other words, there should be no particular problem about distributing these signals using the module(s) described in this article — you'll just need three channels, one for each colour.

On the other hand the two sync signals are digital, and switch between TTL logic levels (i.e., about 2.4V and 0.8V). This means that the voltage swing for these signals is still within the capabilities of the buffers in our distribution amp module, but the impedance level is rather higher — around 1kΩ.

I haven't had time to try it, but there's a good chance that you could use the distribution amp buffers to handle these sync signals merely by changing their input terminating resistors to 1kΩ (instead of 75Ω or 50Ω). Providing the buffer inputs are connected to the computer's VGA output port by fairly short lengths of cable, this should work quite satisfactorily.

Note that when you're using the buffers to distribute VGA sync signals, their output back-termination resistors are probably best left at 75Ω to give the best driving of reasonably long cable runs. Also only change the input resistors to 1kΩ for the buffers which are used to handle the horizontal and vertical sync signals — leave the resistors at 75Ω for those handling the three video signals.

If you follow these suggestions, you should find that this distribution amp module is quite suitable for running multiple computer monitors from a single VGA/S-VGA graphics adaptor. Just remember that you'll need at least two modules (a master and a slave), to provide enough buffers for driving even two monitors, because this requires five buffers in all (three for the video, two for the sync).

With a master and two slave modules, you'll have enough buffers (12) to drive up to four monitors — with a couple left over. ❖

Mini Construction Project:

SANTA'S OWN CHRISTMAS LIGHTS

We've described circuits to control Christmas lights before, including a programmable microcontroller-based system last month. But we thought you'd appreciate this new design, because it comes from a rather special contributor. It also happens to be low in cost and easy to build — so why not build one up, and be rewarded by a special twinkle in your children's eyes?

by S. CLAUS

Ho, ho, ho to you! Well, December 25 is almost with us again and have *I* got a lot to do between now and then. So much so, in fact, that this year I thought I'd enlist the pages of *EA* to drum up a bit of help with my annual effort to spread a bit of Christmas cheer.

Pardon? You didn't know I dabbled in electronics? Well, you have something to learn. The electronics in kids' toys today means I have to be a master of electronics design and construction. I'm even looking at putting in a wafer fab for next year, up here at the North Pole... but that's another story.

These Christmas lights are designed for an impressive light show. They consist of five strings of super-bright LEDs which flash in a random-looking pattern. The flash rate is variable, so you can 'tweak' them to look just the way you like. Each string has six LEDs in it (but this can be changed with suitable modification to the circuit). Standard, rather than super-bright, LEDs could also be used. But because LEDs aren't as bright as tungsten filament lamps, don't consider using these lights in strongly-lit rooms or situations.

The circuit (Fig.1) is the essence of simplicity — which is just as well, because I don't have the time to fiddle with overly complex designs, involving hard-to-get components. It consists of nothing more than a 555 timer (U1) which clocks a CMOS 4017 Johnson (decade) counter (U2). The 10 outputs of the counter are ORed in suitable combinations before being used to switch output transistors that drive the five strings of LEDs. The circuit is designed so that at any one moment, two of the LED strings (i.e., 12 LEDs) will be on.

The circuit also contains an on-board power supply that can be driven from an AC or DC input. You will need a plug pack or suitable transformer. The circuit won't draw much more than 40 milliamps (depending on the drive current used for the LEDs). The minimum AC input is about 11 volts, but be careful not to go too high either or you might overheat the 7812 regulator or damage the main DC filter capacitor (C1).

If you are using a DC input, you will need a minimum of 14 volts — alternatively if you have a regulated 12 volt DC supply, the diode bridge (D1 to D4), C1 and the 7812 regulator can be left out. Simply wire the regulated supply directly to +12 volt and ground on the PCB.

Luckily, I don't have to worry about transformers. All the electrics on my sleigh are driven by a simple coil of wire around the perimeter. As I speed through the ionosphere, the current generated in the coil is enough to drive the lights, and all the other sleigh accessories — most importantly of all, the electric seat warmer!

The only part of the circuit that might be hard to follow is the ORing of the outputs of the 4017 counter (U2). Twenty 1N914 diodes form five OR gates, and the output of each gate controls one string of LEDs. I'm not going to explain how the ORing pattern was chosen, but it was the part of the circuit that took me the most time to design. The aim was to get two sets

Mr Claus sent us this prototype of his flashing light unit, which he admits was 'a bit rough'. Our photographer dummied up a stylised Christmas tree to illustrate one possible use...

Santa's Own Christmas Lights

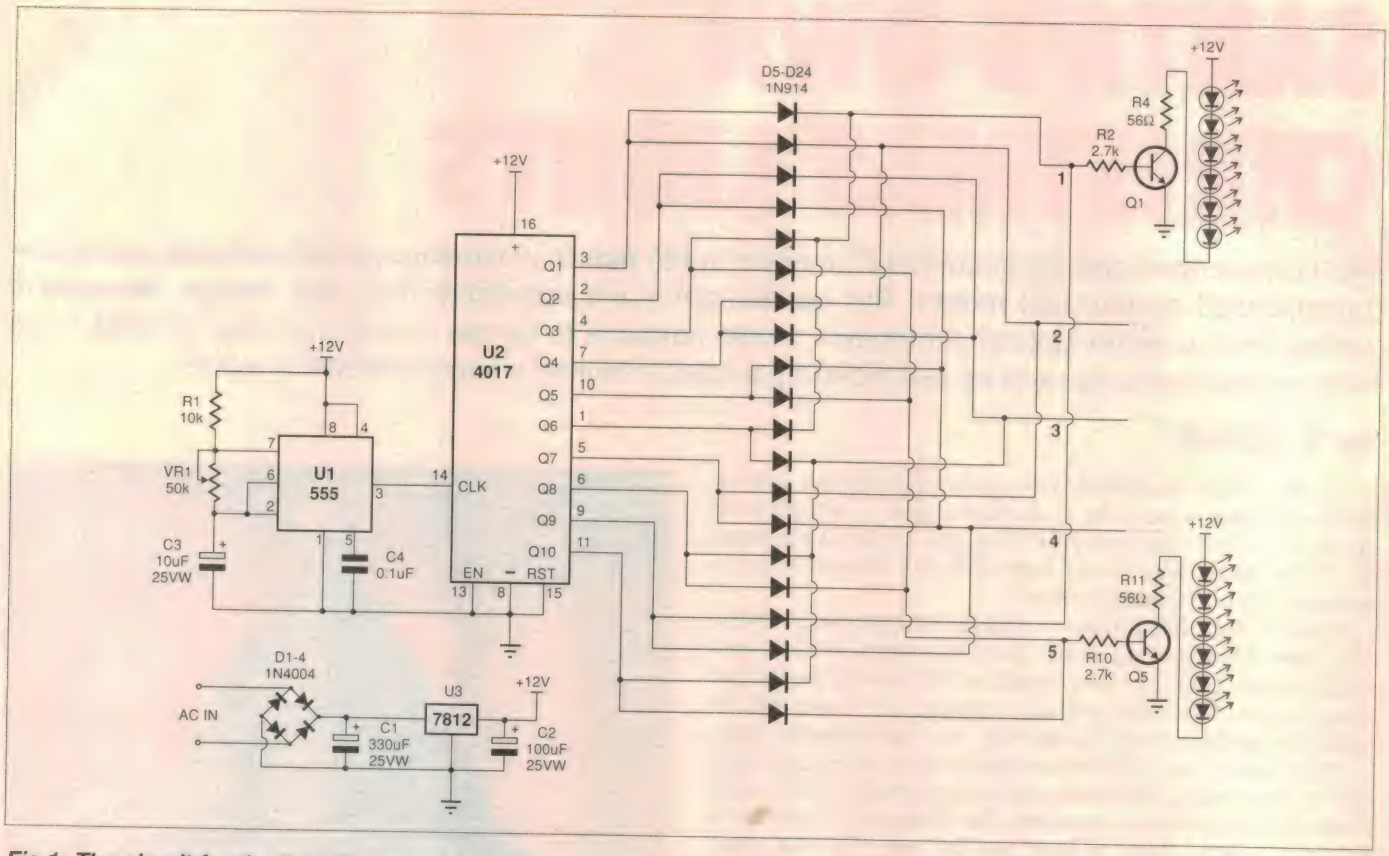


Fig.1: The circuit for the light flasher, which as you can see is very straightforward. A variable oscillator using timer chip U1 drives one-of-ten counter U2, and the diode gating operates LED switching transistors Q1 - Q5 in a 'pseudo random' fashion.

of LEDs on at any one time, and to make sure that when the next pair of strings came on, they were different to the last two strings. Anyway, it works, so why should *you* worry?

Most of the components should be available from your odds and ends box, although a shopping trip for some suitable LEDs might be necessary. I notice that Oatley Electronics seems to have some bright (1 candela) LEDs available at present, priced at only 10 for $4 — they might be worth checking out.

For the LED driver transistors, I have used a mix of BC547 and BC548 types, but only because I had some in my junk box. Just about any NPN switching transistor should do the job — just make sure they have the same pinout as the BC547/548s.

You may need to experiment with the current limiting resistors for the LED strings (R4, R5, R7, R9, R11). I have used 56Ω, 1/4 watt resistors. The LEDs are wired in series and the total voltage drop across them approaches 12 volts. Any small changes in voltage drop resulting from the use of different LEDs could significantly affect the voltage 'gap' from the 12 volt supply. If you are unsure, I would suggest caution when first testing each string of LEDs — try a 100Ω series resistor to start, then work down from this.

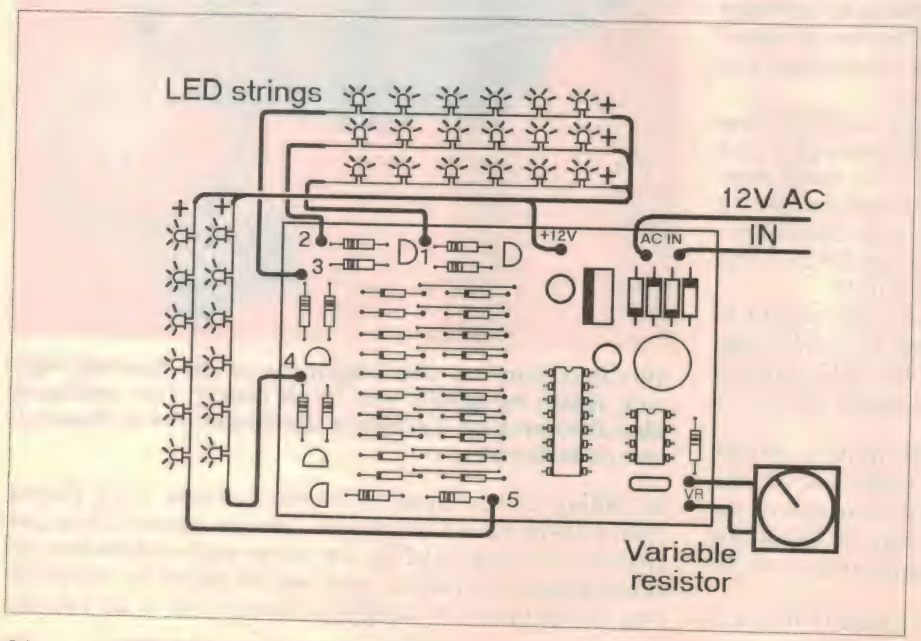
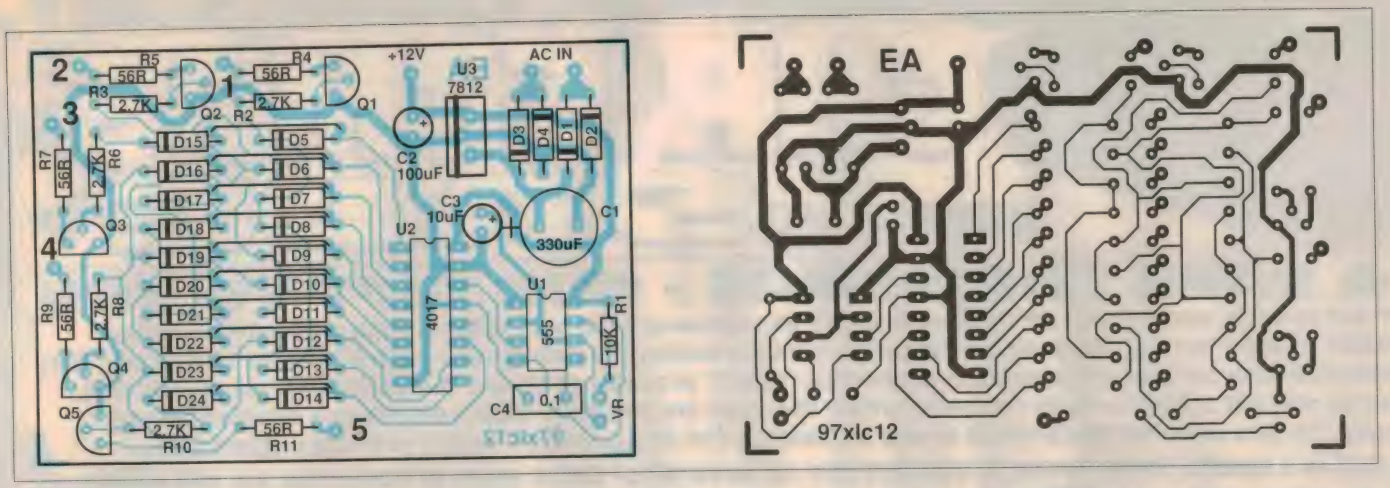


Fig.2: How the five strings of LEDs are connected to the board, with their common anode leads all connected to the +12V pin.

Building it

Construction is straightforward. Take the usual precautions with the PCB, making sure all the diodes and polarised capacitors are orientated correctly. There are 10



Here is the PCB overlay diagram, to guide you in placing all of the components on the PCB, and also the board's etching pattern (actual size) for those who prefer to make their own.

links on the PCB. These run between the two columns of 1N914 diodes.

The externally-mounted variable resistor (VR1) which controls the flash rate must also be connected to the PCB. Two pads for this are marked just to the right of C4 (below U1). Fig.2 shows this and other external connections to the PCB.

The most fiddly part of the project is making up the LED strings. As mentioned, they are created from series-wired LEDs. Be careful to mark and correctly orientate the polarity of each LED as you wire it, and test each string as you complete it. Also mark the anode (or cathode) of each string when done.

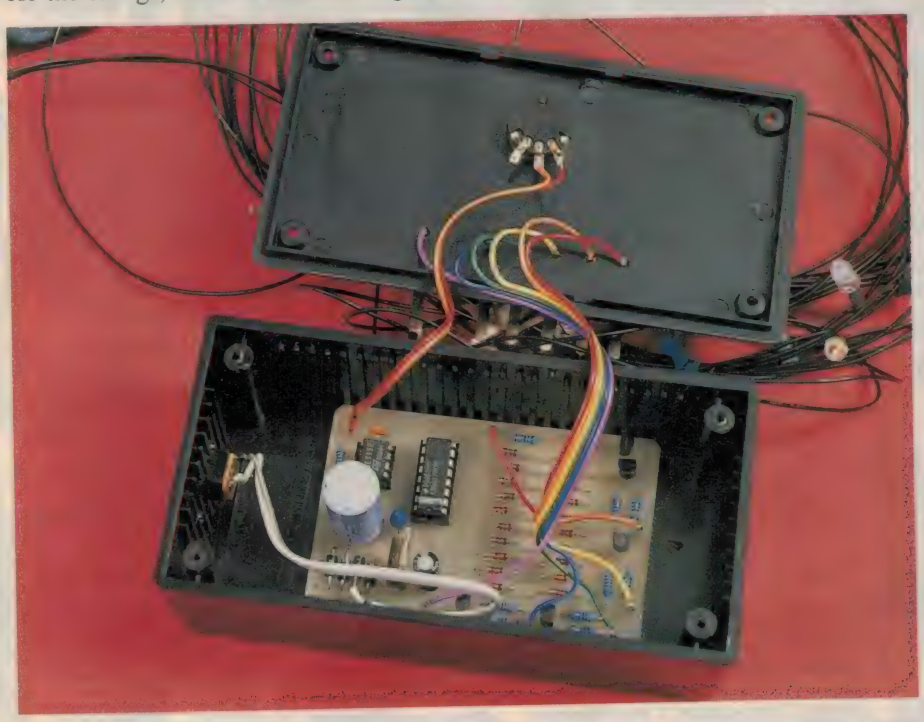
I used light duty black hook-up wire for the strings, cut into suitable lengths to achieve the desired LED spacing. The LEDs were soldered onto the hook-up wire and one bare connection was insulated with a short length of 1.5mm 'spaghetti' sleeving. Both this and the other bare connection were then covered by sliding on a short length of 3mm heatshrink tubing.

The LEDs I used had water-clear lenses and were quite directional. Nevertheless, I found they worked well when viewed off-axis. If desired, you could probably diffuse their output by dabbing a small, thin layer of translucent epoxy or similar onto the end of each LED.

When completed, the board will easily fit into the second smallest jiffy box. Screw terminals or other suitable connectors fitted to the outside of the box can be used for connecting up the LED strings. You will also need to mount the variable resistor through a suitable hole in the jiffy box. A common anode is used for all strings and this is taken from the +12 volt output marked on the PCB. The cathode end of each LED string is wired respectively to the outputs marked 1, 2, 3, 4 or 5 on the PCB.

Well, that's all there is to it. So get out your soldering irons, and get cracking. But whatever you do, don't leave your iron at the bottom of the chimney when you're finished. I might come off the worse for wear if you do — and so might your soldering iron.

Merry Christmas! ❖



A view inside Mr Claus's prototype, showing how he fitted everything into the utility box.

PARTS LIST

Resistors

(All 1/4 watt unless specified)

R1	10k
R2,3,6, R8,10	2.7k
R4,5,7,R9, 11	56 ohms
VR1	50k pot (linear taper)

Capacitors

C1	330uF 25V RB electrolytic
C2	100uF 25VW RB electrolytic
C3	10uF 25VW RB electrolytic (or tantalum)
C4	0.1uF monolithic ceramic (0.2")

Semiconductors

U1	555 timer
U2	4017 CMOS decade counter
U3	7812 voltage regulator
Q1-5	BC547 or BC548 transistor (or similar NPN switching)
D1-D4	1N4004 or similar diodes
D5-D24	1N914 signal diodes

Miscellaneous

PCB 79 x 54mm, code 97xlc12; jiffy box 130 x 68 x 45mm; 2.4mm DC panel socket (or similar, for power connection); approx 20 metres black hookup wire (light duty); 30cm x 1.5mm diam spaghetti tubing, 30cm x 3mm diam heatshrink tubing; six x screw connectors (or similar, for connecting LED strings to controller); knob for variable resistor; hookup wire, tinned copper wire for PCB links; 12V AC supply. Optional: 16-pin and 8-pin IC sockets.

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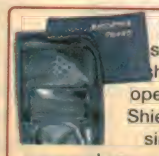
Were $39.95 ea

SAVE $20 1/2 PRICE

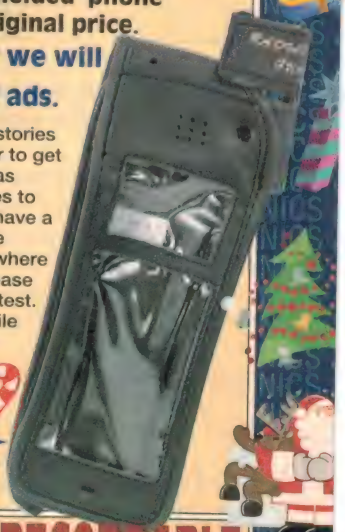


Lead shield shown opened. Shield is simply wrapped around the antenna base.

This superbly designed case also includes a ROTATABLE BELT CLIP, which easily allows you to turn your phone to the horizontal position, allowing you to sit down comfortably.

WHY TAKE THE RISK? We're not sure whether the stories you hear are true or not. Some people it seems, appear to get headaches from continual mobile phone use. Jaycar has sourced a range of genuine leather mobile 'phone cases to suit most popular models. So what? Well these cases have a special lead - yes lead, insert sewn into the lining of the leather case. This lead runs right across the earpiece (where your head is closest to the 'phone) & right around the base of the antenna where RF radiation is generally the greatest. If you are worried about the potential hazard from mobile 'phone radiation why not try one? At $19.95 it costs no more than a standard quality leather case anyway.

NOW ONLY $19.95 each



12 VOLT COMPACT FLUORESCENT LAMPS

Its a common known fact that compact fluorescent lamps use less power to give the same lighting as normal lamps. We have 2 new lights available. These are ideal for caravans, boats, cars, bush houses etc.

PL9W CABIN LIGHT

NEW

This uses a 2 pin PL9 watt tube, which is about equal to a 60 watt globe. There is also a 3 watt courtesy light included, which can be used to give a small amount of light - (to see steps etc). An electronic ballast is used, guaranteeing low current consumption, and it is protected against incorrect battery connection. A 3 position rocker switch is used - centre is off, one way turns the courtesy light on, and the other way turns the compact fluro tube on. This lamp gives out an amazing amount of light when compared to the tubes which are only 125mm long. Current consumption is about 1 amp. Size is 282(L) x 81(H) x 38(D)mm.

Cat. ST-3010

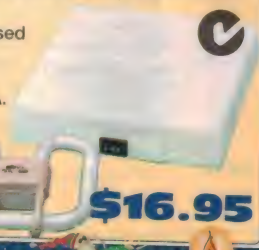
$32.95

Replacement Tube Cat. ST-3011

$6.95

2D 16W SQUARE LIGHT

This unit uses the compact fluro tube called 2D, which is rated at 16 watts, which would be roughly equal to an 80 watt globe. It would be ideal to mount directly over a table, as it has a wide light dispersion. It also has a 3 position switch, with a 3 watt courtesy light included. Can be mounted either surface or recessed mount. Includes an electronic ballast. size is 160 x 160 x 45(D)mm. Current draw is 850mA.



Cat. ST-3012

$42.95

Replacement Tube 2D 16W Cat. ST-3013

$16.95

JAYCAR OPENS IN NEW ZEALAND

As you read this we have been open for nearly a month!

14A Gillies Avenue. Newmarket. Auckland.
PHONE: AK 529 9916
FAX: AK 529 9917

Mention this ad and you will receive a free copy of our 1997 Catalogue and a free gift!! (limit 1 per customer!) Special prices for our NZ customers all the time!!

VIDEO DOORPHONE

NEW

See who is at your front door before opening it! You simply can't be too careful these days. When a visitor presses the doorbell, the video monitor automatically turns on, and you can see who is at the door. You can talk to them, and if you don't know them, ask them their business, without opening the front door. With the optional door release, you can remotely open the front door, and let the visitor in if you wish. The camera has IR LEDs for night illumination, and comes with installation hardware for flush or surface mounting. Supplied with clear instructions can easily be mounted by the family handy person. 1 year warranty.

Cat. QC-3410

Only $469

DOOR RELEASE TO SUIT $34.95 Cat. QC-3415

RECORDABLE CD's 74MIN 680MB

We WILL NOT be beaten on price. TELL US IF WE'RE WRONG!

Genuine gold quality JAPANESE MADE recordable CD's at the best price in town! Cat. XC-4710

1-9	$5.99ea
10-99	$5.39ea
100+	$5.20ea

Remember! Each disc is supplied in a quality CD jewel type (i.e. standard) clear plastic case.

BONUS!! A FREE spare pack of 5 CD Jewel Cases with each 10+ purchased Worth $5.95.

LIMIT 3 PACKS PER CUSTOMER ANY BUY

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

SWITCHES

DPDT Mini toggle with centre off and spring return one way and on the other way.
Cat. ST-0510 NEW $3.95

DPDT Mini toggle with centre off & spring return both sides.
Cat. ST-0512 NEW $3.95

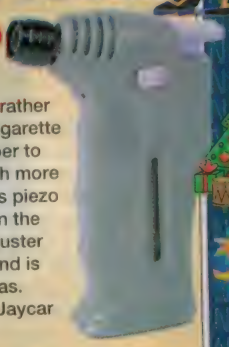
DPDT Large rocker with centre off and spring return both sides. These are commonly used for power car antennas.
Cat. SK-0980 NEW $6.95

DPDT Small rocker with centre off & spring return both sides.
Cat. SK-0987 NEW $3.50

PERSONAL ALARM

This personal alarm is small in size and can be used in different ways. To activate alarm simply pull the pin and it sounds this ear piercing, almost unbearable scream which will attract attention. The pin is attached to a lanyard with a plastic clip on the end which can be attached to keys, or belt loop etc. The alarm could be placed in a ladies handbag, with the lanyard around the hand. If the bag is snatched, the thief has an alarm sounding in the bag! Sure to catch attention. It has its own beltclip so it can be clipped to pants on a belt etc. Size is 55(W) x 67(H) x 20(D)mm. and colour is black.
Cat. LA-5180 NEW
Only $9.95

MINI GAS TORCH



This torch NEW replaces our old Pocke Torch.
This unit is gas fillable, rather cheaper than using a cigarette lighter. It's much cheaper to operate and holds much more gas than a lighter. It has piezo ignition and will ignite in the wind. It has a flame adjuster and an on/off switch, and is really easy to fill with gas. Height is 110mm. Use Jaycar gas (NA-1020 $5.95)
Cat. TS-1682
Only $19.95

MAINS FILTER AND TELEPHONE PROTECTOR

PROTECT YOUR FAX MODEM / CORDLESS PHONE ETC.
This unit is designed to protect both telephone line and AC mains from surges as a result of atmospheric disturbances, such as nearby lightning strikes. Protect computers, faxes, modems and phones. Includes gas arrestors for phone line and metal oxide varistors for mains.
Cat. MS-4025 NEW
Only $32.95

SELLOUT OF GREAT TEST GEAR!!

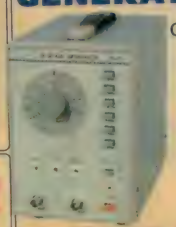
RF SIGNAL GENERATOR

Cat. QT-2312
Was $289
Save $100
Sellout Price $189

AC MILLIVOLT METER

QT-2320
Was $269 Save $70
Sellout Price $199

TV PATTERN GENERATOR



Cat.QT-2325
Was $299
Save $70
Sellout Price $229

RF SIGNAL GENERATOR

Cat. QT-2302
Was $239 Save $60

Sellout Price $179

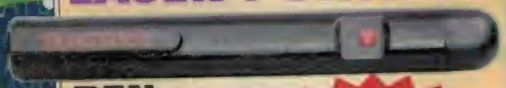
QUANTITIES STRICTLY LIMITED CALL FIRST

AUDIO GENERATOR

Cat. QT-2310
Was $289
Save $100

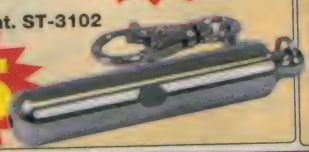
Sellout Price $189

ZAP! ZAP! LASER POINTERS



PEN TYPE
Cat. ST-3100
MAX LEGAL POWER
$39

KEYRING TYPE
Cat. ST-3102
$45



Jaytech 25 MHZ DUAL TRACE CRO

Brand new model with 5" screen and suited to a wide range of applications. Features include a deflection coefficient of 5mv/div to 20V/div in 12 calibrated steps. It also gives algebraic ADD, SUBTRACT, INVERT & X-Y modes. The time base range is from 0.5µsec/div to 0.2 sec/div in 18 calibrated steps. A continously variable uncalibrated control between the steps, along with X5 expansion extends the fastest sweep speed to 40nS/div approx. Variable hold/off, in addition to multimode triggering, provides versatile triggering up to 40Mhz.
SUPPLIED WITH 2 PROBES.
Cat. QC-1900 NEW
$699

JAYCAR KITS

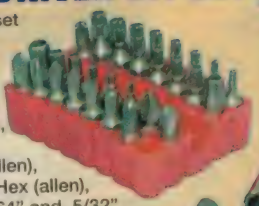
VIDEO ENHANCER & STABILISER

REF: EA NOV. 97. NEW
Improve the quality of images from poor quality video tapes, and reduce degradation when you are making copies. Also includes circuitry which can give more stable viewing of video signals, by stripping out "piggyback" information like vertical - interval test signals and teletext data. The Jaycar kit includes box, punched & silk screened panels, transformer and all specified parts. Cat. KA-1798
$69.95

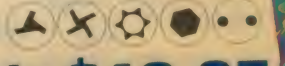
LINE CARRIER LINK

NEW
Refer EA Nov 97 This kit simply controls mains operated devices through 240V mains outlets without the trouble of messy wiring or infra red links. Great for home automation. Kit includes all quality electronic components, PCB, box with silk screened front panel.
Cat. KA-1799
$69.95

"FULL HOUSE" POWER DRIVER BIT SET



All the weirdo driver bits in one go!! -The set consists of 32, of the driver bits that you don't normally see. You don't get any slotted, Phillips or Posidrive bits. You do get: •4 x Tri - wing, size 1, 2, 3, and 4 •9 x Torx (tamperproof), size T8, T10, T15, T20, T25, T27, T30 and T35 •4 x Pin drive (snake), size 4, 6, 8 and10 •6 x In - Hex (allen), *metric, size 2, 2.5, 3, 4, 5 and 6 •6 x In - Hex (allen), *imperial size 5/64", 3/32", 7/64", 1/8", 9/64" and 5/32" •3 x Torque Set, size 8, 9 and 10. With this you get a hex driver with magnetic retainer, all in a nifty plasticy - rubber holder that is smaller than a deck of cards! (67 x 45 x 30mm). you will never get stopped by a wacko screw ever again!! Cat. TD-2035



SAVE $10 Now Only $19.95

HARD DRIVE BIBLE

NEW

The ultimate book on Hard Disc Drives for personal computers. This book is ideal for any person who needs to know about drives at a hardware or "machine" level. Hardbound, it comes in at 430+ pages. The book begins with the listing of hard-drive development through to the latest refinements. Subjects covered include: Basic drive operation, media and heads, stepper motor servo systems, voice coil systems, data encoding and decoding, interface standards (all of them!) including latest ultra SCSI, QIC36, SA400 and future trends, controller setup and jumping, drive cabling, drive types, formatting, DOS partitioning, Macintosh and PC formats, Windows 95, hardware compatibility problems, common installation problems, trouble shooting, controller information, etc. (Phew!) In addition to this is full technical data on virtually every hard-drive ever made, including all pinouts!! It also covers CD-ROM drives, tape drives and even floppy drives!! Also included are lists of the authors benchmark tests for establishing drive performance. This is the most fantastic manual we have ever seen on any product, let alone such an arcane subject. The hard cover format welcomes continuous professional use.
Measures 210mm x 270mm.
Cat. BC-1210

Special Introductory Price $49.95

BUY 10 LESS 10%

THE LATEST KITS

STEPPER MOTOR DRIVER CARD KIT WITH ONBOARD BUFFER

Ref: Silicon Chip Dec 1997

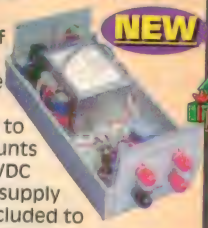
NEW

Eight of these new cards can be daisy chained and connected to one PC printer parallel port, with one card capable of driving a single motor. Each card can be coded with a different address making them individually selectable and, if the need arises, two or more can be jumpered with the same address in a master-slave setup. Being buffered, your PC can dump data into the card then carry out other tasks without being tied up. Kit includes PCB, heatsink bracket, hardware plus all specified electronic components.

Cat. KC-5236 **$55.00**

POWER SUPPLY KIT FOR STEPPER MOTOR CARDS

Ref: Silicon Chip Dec 1997

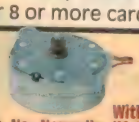


NEW

This power supply is capable of driving several stepper motor driver cards, depending on the current consumption of the motors. It can supply around 2 to 2.25 amps with moderate amounts of ripple with both 12V and 18VDC rails available. A +5V regulated supply for the logic circuitry is also included to readily power 8 or more cards. The kit includes high quality case, transformer, PCB plus electronic components.

Cat. KC-5237 **$59.50**

STEPPER MOTORS



All motors supplied with data and applications information.

	Cat. No.	Normally	With Kit KC-5236
SANKYO 7.5° Step HI Torque	YM-2750	$28	$25
MINEBEA 7.5° 6Ω Coils	YM-2752	$20	$18
MINEBEA 7.5° 15Ω Coils	YM-2754	$16	$12

OTHER STEPPER KITS

KC-5157 (Drive 2 Motors) PC operated **$39.95**
KC-5226 (Manual Control) Drives 1 motor **$19.95**

LOUDNESS CONTROL KIT FOR CAR SOUND SYSTEMS

NEW

Ref: Silicon Chip Dec 97

Although its hard to believe, many modern car systems have loads of features but lack a loudness control. If you wish to retain the "power" of your music when forced to lower the volume, then this simple kit is the answer. Connects between your tape/CD and crossover, and accepts a line level input with a bypass switch and boost potentiometer included to control the final sound. PCB, quality gold RCA sockets, case plus elec components included.

Cat. KC-5239 **$24.95**

SPEED ALARM KIT FOR CARS

Ref: Silicon Chip Dec 1997

NEW

Designed with the same sensor in mind as the latest Commodore. Two push button switches select the speed at which the alarm will trigger in increments of 5km/h, with the designated speed indicated on a 3 digit LED display. When triggered, a piezo alarm sounds along with a visual indicator warning you to slow down. Speed is monitored by a magnet/sensor assembly attached to/near the driveshaft. Increase safety and avoid hefty fines and loss of points/license. The Jaycar kit includes cases, PCBs, front panel, red perspex lens, auto cable and connectors, all electronic components plus a free set of IC sockets.

Cat. KC-5238 **$89.50**

AUDIO MASKER KIT FOR TINNITUS SUFFERERS

Ref: Electronics Australia December, 1997.

NEW

Tinnitus is a term used to describe ringing in the ears, or any other form of perceived sound that doesn't come from an external source. For some it can be just an annoyance, for others it can become a nerve-wracking condition. This kit will provide some relief by generating a backround sound such as a strong rushing waterfall down to the soft sound of wind blowing through trees. Kit includes case, front panel, PCB plus all electronic components. 9V battery not included - use SB-2370 $3.40.

Headphones also required, use AA-2016 $4.95 Cat. KA-1800 **$24.95**

Jaycar ELECTRONICS

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PHONE: (02) 9743 5222
FAX: (02) 9743 2066

Quality System — Quality Endorsed Company ISO9002 Lic 6143 Standards Australia

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ORDERS: 1800 620 169
FAX: (02) 9743 3070
FREEFAX: 1800 810 137

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Reply Paid 72. Jaycar Mail Orders. PO Box 185 Concord NSW 2137 FREE CALL FOR ORDERS: 1800 022 888
ENQUIRY HOTLINE: (02) 9743 6144 FAX: (02) 9743 2066

POST & PACKING $10 to $24.99=$4.00 $25 to $49.99=$5 $50 to $99.99=$7 OVER $100=$8

ROAD FREIGHT ANYWHERE IN AUST (up to 20kg) $14.00

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ADELAIDE SA •194 Wright St (Cnr. Selby St) •Ph:(08) 8231 7355 •Fax:(08) 8231 7314 •Mon/Fri:9-5.30 •Fri:9-8.30 •Sat:9-4

BURANDA QLD •144 Logan Rd •Ph:(07) 3393 0777 •Fax:(07) 3393 0045 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4

ASPLEY QLD •1322 Gympie Rd, cnr Albany Creek Rd •Ph:(07) 3863 0099 •Fax:(07) 3863 0182 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4

CANBERRA ACT •121 Wollongong Street, Fyshwick •Ph:(02) 6239 1801 •Fax:(02) 6239 1821 •Mon/Fri:9-5.30 •Sat:9-4

MELBOURNE CITY •Shop 2,45 A'Beckett St •Ph:(03) 9663 2030 •Fax:9663 1198 •Mon/Fri:8.30-5.30 •Fri:8.30-8.30 •Sat:9-4 •Sun:10-4

COBURG VIC •266 Sydney Rd •Ph:(03) 9384 1811 •Fax:(03) 9384 0061 •Mon/Fri:9-5.30pm •Fri:9-8.30 •Sat:9-4 •Sun:10-4

SPRINGVALE VIC •887-889 Springvale Rd Mulgrave, Nr Cnr. Dandenong Rd •Ph:(03) 9547 1022 •Fax:(03) 9547 1046 •Mon/Fri:8.30-5.30 •Fri:8.30-8.30 •Sat:9-4 •Sun:10-4

HOBART TAS •140 Campbell St. Hobart •Ph: (03) 6231 5877 •Fax:(03)6231 5876 •Mon/Thur:9-5.30 •Fri:9-7 •Sat:9-4

SYDNEY CITY •129 York St •Ph:(02) 9267 1614 •Fax:(02) 9267 1951 •Mon/Fri:8.30-6 •Thurs:8.30-8.30 •Sat:9-4 •Sun:10-4

BANKSTOWN •363 Hume Hwy Cnr Meredith •Ph:(02) 9709 2822 •Fax:(02)9709 2007 •Mon/Fri:9-5.30 •Thurs:9-8.30 •Sat:9-4 •Sun:10-4

GORE HILL •188 Pacific Hwy Cnr. Bellevue Ave •Ph:(02) 9439 4799 •Fax:(02)9439 4895 •Mon/Fri:9-5.30 •Thurs:8.30 •Sat:9-4 •Sun:10-4

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NEWCASTLE •830 Hunter St. (Cnr Stewart Ave) •Ph:(049) 653 799 •Fax:(049) 653 796 •Mon/Fri:9-5.30 •Sat:9-4

PERTH •326 Newcastle St Northbridge •Ph:(08) 9328 8252 •Fax: (08) 9328 8982 •Mon/Fri:9-5.30 •Thurs:9-7.00 •Sat:9-4

NOW OPEN IN NEW ZEALAND 14A Gillies Ave. Newmarket. Auckland. Phone: AK 529 9916 Fax: AK 529 9917

CONTROL THAT MESS OF CABLES BEHIND YOUR PC OR HI FI

NEW

Sometimes simple ideas are the best. This device is a length of flexible corrugated conduit which is split lengthwise. You use it, with instructions provided to trunk all cables leading to and from equipment into one neat bundle which fits inside the conduit. Cables that branch off simply exit from the slit! It makes for a really neat computer or Hi Fi installation! Also included in the kit are wire ties and special coloured labels to enable you to keep track of individual leads once the whole lot is bundled up! Conduit is grey in colour, 2m long and 22mm dia. (expandable).

Cat. HP-1230

WITHOUT WIRE MANAGER

WITH WIRE MANAGER

Only $19.95

100W 12V HALOGEN GLOBE

NEW

These are used in hand held spotlights and are extremely bright. Fitting and contact is by 2 pins which are 6mm apart. Length including pins is 40mm. Do not touch the glass with your fingers. Ideal for experimentors.

Cat. SL-2724 **$3.95**

MAINS (TWIN/EARTH) HOUSE WIRING CABLE

NEW

Twin Earth Flat Cable
1.0 sqmm 1/1.13, 10 amp (lights)
Cat. WB-1565 **$1.20/m or $95/100m**

Twin Earth Flat Cable
2.5 sqmm 7/.067, 20 amp (power)
Cat. WB-1568 **$1.75/m or $140/100m**

10 metres or more - less 10%

BLADE FUSES

MINI BLADE

Used in cellular phone hand free kits etc.
3A Pink Cat. SF-1910 5A Yellow Cat. SF-1912

$0.75 ea

MAXI BLADE

Used in big power amps etc.
20A Yellow Cat SF-1930
40A Orange Cat SF-1934
60A Grey Cat SF-1938

$5.95 ea

SCOOP PURCHASE OF THE DECADE

AURA INTERACTOR

Plug it into computer games, stereos etc, then put the back pack on and feel all the low frequency sounds.

See previous ads for full details.

SAVE $210!

WAS $249 THEN $49.95

Cat. XC-1000 **DECEMBER $39.95**

A CHRISSY PRESENT FROM YOU TO YOU?

Use this month to upgrade your multimeter. Get this: Autorange, 3.75 Digit 3260 Count plus Bargraph, Capacitance, Frequency, Data Hold, Continuity Buzzer, Transistor & Diode Test, 10 Amp, Includes Holster. Refer catalogue page 20 for full info. Cat. QM-1530

Normally $89.95 Save $20

Christmas Sale Price $69.95

PLUG INTO GREAT SAVINGS THIS XMAS! 200mA for free!!!

Christmas time is heavy on batteries, so why not eliminate them? The Jaycar MP-3012 gives 3.0, 4.5, 6.0, 7.5, 9.0 & 12V at up to 500mA (unregulated, so be careful) with 7 polarity reversible plug adaptors at a normal price of $24.95. This month you can have one for less than the price of a 300mA version!

Cat. MP-3012 **Normally $24.95 Save $6**

This month only $18.95

SHORT CIRCUITS

IDEAL FOR KIDS!

LEARN ELECTRONICS

Short Circuits assumes they know nothing about electronics. The book shows you what electronic components look like and how they work. There are 21 projects to build and all the components are supplied to build all the projects. There is no soldering required and all components are mounted on a baseboard with springs. Some projects are: •Short circuit tester •Police siren •Sound effects •Light chaser •Solar powered radio •Amplfier •Buzzboard & more.

SHORT CIRCUIT BOOK & PROJECT KIT

Cat. KJ-8502 **$24.95** *Used In Schools

MAIL ORDER CORNER

These products are ONLY available by ordering on our Mail Order Dept. Direct. Simply call 1800 022 888 and have your credit card handy! **P&P charges $4**

OK SOLDER STATION

Buy in December at $199 & receive free 1Kg. roll of solder worth $24.95 Cat. NS-3002

Cat. NS-3002

Only $199

Cat. TS-1620

HARD TO GET PANEL METER SALE!

All supplied with mounting hardware.

Description		Comments	Price (ea)
0-300VAC	MU65 Style 65W x 60Hmm	Class 2.5	$10
0-40VDC	MU65 Style 65W x 60Hmm	Class 2.5 BRAND NEW	$5
0-60VDC	MU65 Style 65W x 60Hmm	Class 2.5	$5
0-20VDC	45mm Square	Really Cute!	$6
0-10ADC	MU65 type 65Wx60Hmm & shunt	Class 2.5	$15
0-60ADC	MU65 type 65Wx60Hmm	50mV Shunt rqrd	$6
0-75ADC	80mm Square	50mV Shunt rqrd	$6
0-100ADC	80mm Square	50mV Shunt rqrd	$10
-30/0/+30ADC	70Wx60H University Brand Shunt rqrd Aust made		$30
40/50/60Hz	Analogue freq meter 80x80mm, 100mm deep 220-240V		$40

Small quantities of other meters available - please ask!

SHUNTS TO SUIT METERS

We also have a quantity of beautifully made high current shunts. They are hand made by instrument fitters (a lost trade?) and feature brass/bronze silver soldered electrical work. Many are mounted on bakelite plinths. Prices range from $5-$10, depending on size. Most shunts are boxed and present as new, some are unboxed and are therefore slightly soiled. All are brand new however. From 50mV@60A to 75mV 250A. Ask for details when ordering.

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

Construction project:

LINE CARRIER LINK FOR HOME AUTOMATION - 2

Here's the second part of our series on building your own digital control system that communicates via the existing 240V AC house wiring, using our new Line Carrier Transmitter and Receiver units. In this instalment, we'll cover the construction and testing of each module, and discuss a number of ways the system can be expanded to perform more elaborate home automation jobs.

by ROB EVANS

Assembling both the Line Carrier Receiver and Line Carrier Transmitter is quite a straightforward process, with the only fiddly part being the job of winding the line coupling transformers (T2 in both units). As you can see from the internal shots of the prototypes and their matching overlay diagrams, virtually all of the parts (including the power and coupling transformers) fit onto a single PCB in each case, and the boards in turn fit into standard 50 x 90 x 150mm plastic instrument cases.

Note that the published designs and our matching prototype units are configured as a basic single channel ON/OFF transceiver system — that is, two commands (ON and OFF) can be passed to one receiver unit. This is very useful in itself of course, but is really only the starting point of what can be done with the system.

If you plan to use more of its capabilities by putting together an elaborate multi-channel and/or multi-control transceiver setup, then you should be aware that extra circuitry, sockets, switches and possibly a larger box will be needed. In this case we'd recommend that you first read through the present article completely so that you have a clear idea of what's required, then build up the two units with those changes in mind. Make sure you don't miss the later 'Expanded capabilities' section, in particular.

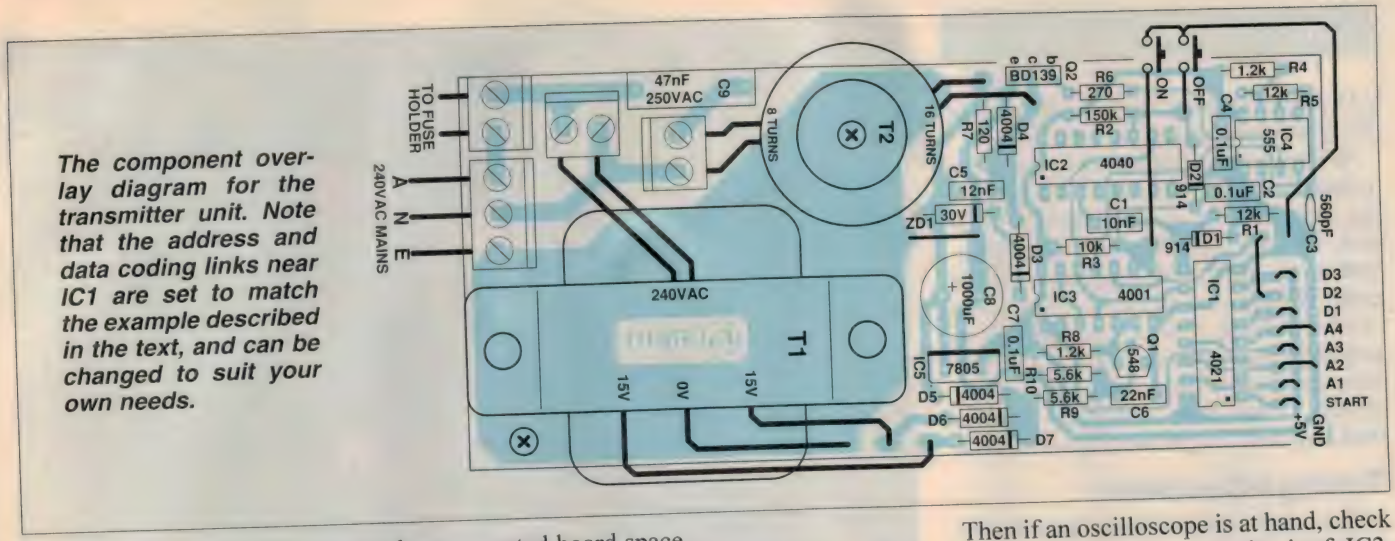
Inside the transmitter.

Another point that you should keep in mind during the assembly and testing of the transmitter/receiver units is that like other mains-powered construction projects, there are lethal voltage levels inside these units which should be treated with due respect. During the assembling stage all exposed 240V AC connections should be well insulated with suitable sleeving, and particular care should be taken when the completed units are being tested or adjusted.

Transmitter assembly

The Line Carrier Transmitter uses a single PCB which is coded 97lct11, measures 55 x 120mm, and ultimately bolts directly to the bottom of the plastic case. As you can see, both the power transformer (T1) and line coupling transformer (T2) mount on the PCB itself, and all mains connections are via two- or three-way insulated PCB mount terminals. Note that since the connections between these terminals are made via PCB tracks, which can be in contact with the bottom of the case, a plastic (that is, insulated) rather than metal box **must** be used for this project.

Begin the construction in the usual way by first fitting all of the lower-profile components to the PCB, then work your way through to the larger parts while using the component overlay diagram as a reference at all times. As usual, take particular care with the ori-



The component overlay diagram for the transmitter unit. Note that the address and data coding links near IC1 are set to match the example described in the text, and can be changed to suit your own needs.

entation of *all* semiconductors and any electrolytic capacitors (C8, in this case).

There are several wire links which must be installed, by the way, and their positions should be quite apparent from the overlay diagram — don't forget the one near ZD1. Note that the series of links near IC1 determine the transmitting address and data codes, and depending upon your preferences, may end up being in a different configuration to that shown on the overlay — see later for more information.

The line coupling transformer (T2) is wound on a 25mm high-permeability (F9) toroid, with a 2:1 winding ratio between the 'driven' winding (at Q2) and the mains winding, respectively. Assemble the transformer by first winding on eight turns of medium-duty **mains-rated** hookup wire for the 'mains' side, then add 16 turns of light-duty hookup wire for the driven side, while using the prototype's internal shots as a guide.

This winding arrangement really isn't too critical by the way, and if the turns are slightly loose or not of the exact number specified (16:8) it won't be too much of a problem. Also, the final result will be neater and more stable if you insert a plastic or rubber plug through the centre of the completed transformer. This will hold the windings in place, and with any luck provide a convenient anchor point for the transformer itself — rubber grommets or round mounting feet work well here.

When it comes to mounting the transmitter's power transformer, you may have to enlarge or shift the matching PCB mounting holes, depending upon the size and construction of the 2855-style transformer at hand. There's not a great deal of free space around the two transformers, so if T1 is on the largish side you should check that both transformers will comfortably fit in the allocated board space.

Another important point to note is that one end of the power transformer (T1) **must** be bolted directly to the PCB for earthing purposes, with a star or other locking washer included to ensure a reliable electrical connection. We used the mounting flange nearest the lower edge of the board for this purpose, while the upper flange (nearer the centre of the board) was used as one of the mounting points for the finished board assembly.

The completed board is bolted into the plastic case at T1's upper mounting flange (as mentioned above), and also at the mounting point shown at the lower right-hand corner of the board in the overlay diagram. This simple approach works well, but really needs some kind of insulated spacing material between the PCB and the case — thin sections of polystyrene or packing foam do the job nicely.

As usual, take particular care with both the mechanical and electrical connections of the mains wiring, which in this case really just involves the mains power cable and the fuse wiring points. Note that the box cable entry point should be fitted with a suitable rubber grommet or plastic collar, the mains cable mechanically anchored with a matching P-clamp as shown, and all exposed mains connections must be well insulated with heat-shrink or cambric sleeving.

Once you are happy with the mounting and wiring of all the transmitter's hardware components — PCB assembly, pushbutton switches, fuse holder and mains cable — double check your work against the supplied overlay diagram, and you're ready for the unit's initial tests.

Until the receiver unit is available for a full practical test of the link however, the best idea at this stage is to just check the most basic aspects of the completed transmitter. First, apply power to the unit and carefully check the +20V and +5V supply rails with a multimeter. Then if an oscilloscope is at hand, check the clock waveform at pin 4 of IC3. Note that the +20V supply need only be within a couple of volts of that figure, but the +5V rail should be in error by less than +/-200mV. The clock waveform should appear as a 100Hz stream of negative-going (roughly) 2ms pulses.

Receiver assembly

The receiver assembly process is pretty much the same as that for the transmitter unit, and involves many of the same hardware components. Again, virtually all of the parts fit onto a single PCB, which in this case is coded 97lcr11 and measures 73 x 132mm.

When assembling the components on the receiver board take careful note of the component orientation as shown on the overlay diagram, and in particular the placement of IC5 and IC4, which face in opposite directions. The four links on the board (LK1 to LK4) set the receiver's address by the way, and can be altered to suit your needs — see later for more details.

Other than that, the receiver unit has a larger number of mains connection points — including two mains leads ('in' and 'out') — and a PC-mount mains control relay RLA1. The completed PCB assembly can be mounted in the case in the same fashion as the transmitter unit, and all 240V AC connections should be secured and insulated as mentioned above. As usual, double check your work before applying power to the finished unit.

Assuming at this stage that you have set both the transmitter and receiver address links to the same value, you can now perform the initial checks and tuning adjustment on the receiver circuit. The 'default' address setting shown in the overlay diagrams corresponds to a binary value of 1010 by the way, and this is probably a good starting point for your

address, since this is the bit order used in the circuit description for both units.

With power applied, quickly check the voltage level at both sides of the regulator chip IC6. As in the transmitter circuit, the 15V figure is really just a nominal level, and the 5V reading should be quite close to the mark. If you have a 'scope at hand, you might also like to confirm that the clock signal at the collector of Q1 is a series of positive-going pulses, which have a duration of less than 1ms and a repetition rate of 100Hz.

Tuning adjustment

The only preliminary adjustment needed to set up the Line Carrier system is tuning the receiver's tone decoder front-end (IC1) to match the transmitter's burst oscillator IC4. The latter is set to a nominal frequency of around 100kHz, and the receiver can be tuned to match this transmission once a line carrier link is set up. Note that an insulated adjusting tool should be used for this job.

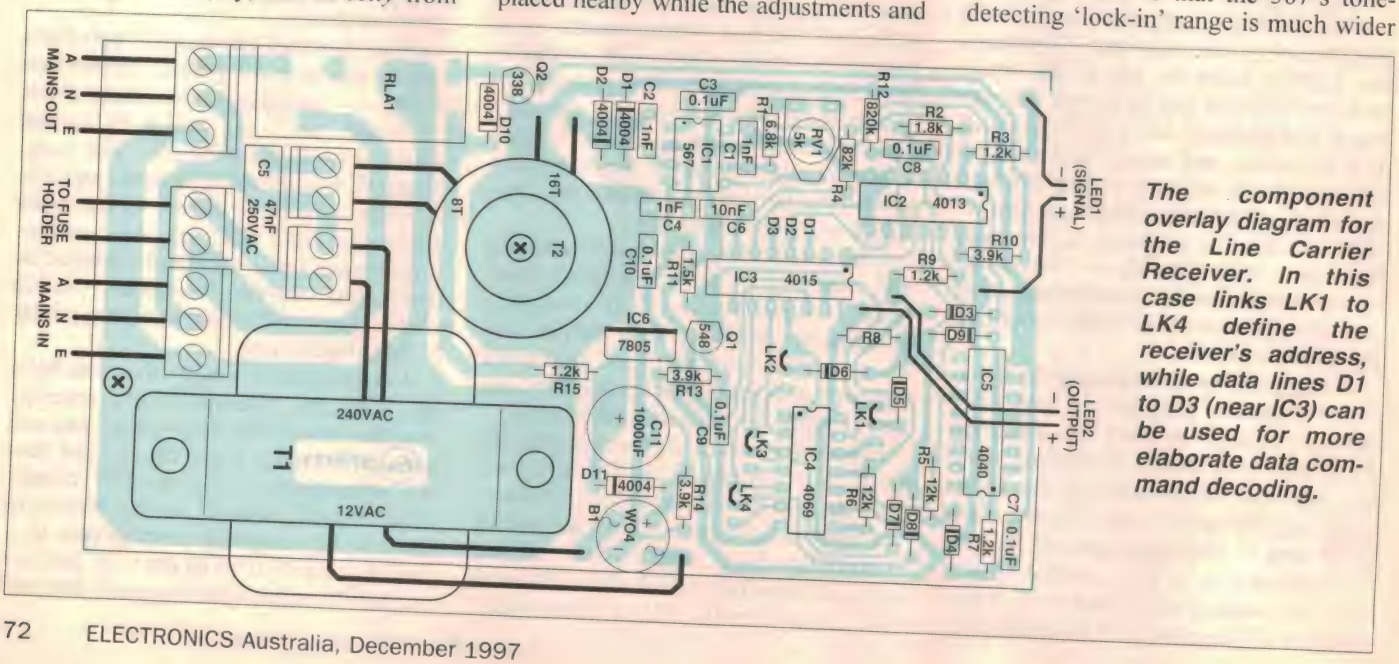
In practice, you will need to set up the transmitter and receiver units in close proximity, then hold one of the transmitter's buttons down while adjusting the receiver's tone decoder tuning trimpot RV1 for a reliable indication on the 'Carrier signal' LED. While this is a very straightforward operation, the actual test setup will need to include a degree of signal *attenuation* between the receiver and transmitter.

The reason for this slight complication is that while the receiver's front end can handle 100kHz signals down to quite low levels (tens of millivolts), a very high level (say, that *directly* from the transmitter) will tend to saturate the tone decoder's input stage. This in turn cripples the 567, and the initial tuning adjustment can't be performed.

Perhaps the simplest — and certainly the safest — way to provide this attenuation is by using a very long mains extension cord to interconnect the two units during the testing phase. In this way, the receiver and transmitter can then be placed nearby while the adjustments and checks are made, and a reasonable degree of signal attenuation is assured.

As a word of caution though, if you find that the tone decoder's tuning is rather broad — that is, the carrier signal LED is active over a wide range of RV1 — then you probably need to insert even more attenuation into the link, in order to arrive at an accurate tuning point. The reason for this is that the 567's tone-detecting 'lock-in' range is much wider

An interior shot of the receiver unit, when built up as a basic two-command single-channel unit. The previous photo shows the matching transmitter's internals.



The component overlay diagram for the Line Carrier Receiver. In this case links LK1 to LK4 define the receiver's address, while data lines D1 to D3 (near IC3) can be used for more elaborate data command decoding.

for higher signal levels, while a low level signal can only be detected if the 567's free-running frequency is very close to that of the incoming frequency — that is, it's accurately tuned.

Note that while these 567 characteristics provide a few complications during the initial tuning stage, they aren't a problem when the Line Carrier link is being used in a practical situation. A very high signal level is unlikely, since there is no real reason to make a connection in such close proximity, and the 567 merely detects moderate level signals in the normal way — they're just easier for it to detect than low-level ones...

That's about it for the construction and commissioning of the Line Carrier Transmitter and Receiver. At this point you should be able to simply plug in the receiver at some distant location in your home, then enjoy the benefits of a reliable single-channel remote link.

As a last point in this respect, please note that the first instalment (November issue) contained a slight error in the text for the Transmitter circuit description on page 72. The OFF binary code example is shown as 11010111, but should in fact read 11010101.

Expanded capabilities

As discussed in the first article, the circuitry for both units has been designed so that up to 16 receivers can theoretically be addressed by one transmitter unit, and up to eight different commands sent to each — that's 128 possible transmitter commands!

Since it's rather impractical to build a transmitter unit with 128 buttons on the front panel, in this case the unit would really need something along the lines of a microcontroller-driven keypad or a very elaborate combination of switches and buttons.

However a rather more convenient approach for this type of fully-blown system is to connect a PC's standard parallel (printer) port to the transmitter unit, and generate all of the coding commands from software running on the PC. This is quite a practical proposition, since the data and address inputs lines at the transmitter's shift register (IC1) are compatible with a printer port's (nominally) 5V logic levels.

To implement this system in practice, you will first need to isolate the existing two-switch system by removing the connections for PB1 and PB2, removing D2, and disconnecting the data bit link between IC3c and IC1's P1 input (pin 6). The remaining address and data bit links at IC1 can then be removed (six, in all), while leaving the start bit link (at pin 1) in place.

The parallel port lines can then be connected to the circuit via a standard DB25 connector, with seven of the incoming data lines wired to the transmitter's address and data pins (P6 to P0 on IC1), and the remaining data line connected to pin 11 of IC2 (where PB1 was connected). This latter point is effectively the 'transmit ON/OFF' control line by the way, and when held at a low level will force the transmitter to repeatedly send the current address/data code.

A suitable arrangement here would be to connect the port's D0 line (pin 2 of the DB25) to this control point, and wire the port D1 to D7 lines (pins 3 to 9) to IC1's P0 to P6 inputs (pins 7 to 4, and 13 to 15). In this way the parallel port's least significant bit (LSB) will enable and disable the transmitter, while the remaining bits define the code to be sent — except for the start bit, which has been hard-wired.

Thanks to this relatively simple interface then, sending a (say) 10101110 code from the PC to the transmitter unit will cause a 11010111 code to be continually sent at the 160ms repeat rate. Note that the transmitter adds the start bit (1) to the code, while the PC's last (LSB) bit is the transmit ON/OFF control code. Sending a 10101111 from the PC will then stop the repeated transmission, since the LSB is now set to one.

Regardless of all the ones and zeros though, the bottom line here is that sending a (decimal) value of 174 from the PC to the transmitter unit will force it to send a command value of 7 to receiver number 10. Remember that the format is: start bit, four address bits, then three 'command' bits. A following code of 175 from the PC will then stop transmission, in this example.

The codes can be sent from the PC in a variety of ways, ranging from simple programs written in QBASIC to elaborate controller software created by one of the Windows-based high level languages. In QBASIC for example, the line LPRINT CHR$(174) will send the decimal value 174 (rather than the ASCII characters 1, 7 and 4) to LPT1. Then by using the TIMER function to create a delay of (say) a few hundred milliseconds, a following line of LPRINT CHR$(175) can then be used

PARTS LIST

Transmitter

Resistors

R1,5	12k
R2	150k
R3	10k
R4,8	1.2k
R6	270
R7	120
R9,10	5.6k

Capacitors

C1	10nF MKT
C2,4,7	0.1uF MKT
C3	560pF ceramic
C5	12nF MKT
C6	22nF MKT
C8	1000uF 25VW electro
C9	47nF 250V AC-rated

Semiconductors

IC1	4021 shift register
IC2	4040 counter
IC3	4001 quad NOR
IC4	555 timer
IC5	7805 +5V regulator
Q1	BC548 NPN transistor
Q2	BD139 NPN transistor
ZD1	30V 1W zener diode
D1,2	1N914 diodes
D3,4,5,6,7	1N4004 diodes

Miscellaneous

T1	30V CT 150mA power transformer
T2	25mm high-mu F9 toroid (NEOSID 28-780-36)
PB1,2	panel-mount pusbutton switches

3 x two-way PC-mount terminals, 1 x 3-way PC-mount terminals, panel-mount fuseholder, plastic case (150 x 90 x 50mm, or similar), PCB (120 x 55mm) coded 97ict12, mains power cord with plug, 250mA fuse, plastic P-clamp, nuts and bolts.

Receiver

Resistors

R1	6.8k
R2	1.8k
R3,7,9,15	1.2k
R4	82k
R5,6,8	12k
R10,13,14	3.9k
R11	1.5k
R12	820k
RV1	5k

Capacitors

C1,2,4	1nF ceramic
C3,7,8,9,10	0.1uF MKT
C5	47nF 250V AC-rated
C6	10nF MKT
C11	1000uF 25VW electrolytic

Semiconductors

IC1	567 tone decoder
IC2	4013 D-type flipflop
IC3	4015 shift register
IC4	4069 hex inverter
IC5	4040 counter
IC6	7805 +5V regulator
Q1	BC548 NPN transistor
Q2	BC338 NPN transistor
LED1,2	5mm LEDs: red, yellow
D1,2,10,11	1N4004 diodes
D3,4,5,6,7,8,9	1N914 diodes
B1	WO4-type bridge rectifier

Miscellaneous

T1	12V 150mA power transformer
T2	25mm high-mu F9 toroid (NEOSID 28-780-36)
RLA1	240V AC-rated SPDT relay, 12V coil

2 x two-way PC-mount terminals, 2 x 3-way PC-mount terminals, panel-mount fuseholder, plastic case (150 x 90 x 50mm, or similar), PCB (133 x 73mm) coded 97lcr12, mains power cord with plug, mains power cord with socket, 100mA fuse, plastic P-clamps, nuts and bolts.

NOTE: For NEOSID toroid cores call Phoenix Components on (02) 990 55866 or fax (02) 9905 5851.

to terminate the transmission.

Creating a program for the transmitter unit will be simpler if the printer port's handshaking lines are hard-wired to suitable levels, by the way. A good starting point here is to wire the Acknowledge, Busy and Paper-out lines LOW (pins 10, 11 and 12 linked to ground) and the Error line HIGH (pin 15 to +5V) at the transmitter's DB25 connector.

Other possibilities

If you would like to expand the capabilities of the transmitter to a moderate degree, but don't wish to use a PC control setup, you will need to install extra pushbuttons in the case *plus* additional support circuitry. This would be some kind of simple button 'decoding' system that produces a specific seven- or eight-bit code for each button press, plus a 'trigger' circuit to activate the transmitter when any button is pressed.

While this would involve more hardware work than the PC-based system discussed above, we would imagine that experienced constructors would have little trouble in knocking up something to suit. We're currently looking at a fairly straightforward diode matrix arrangement for this button decoding task, and hope to describe a small add-on board for the transmitter in the near future.

As you might also imagine, the Line Carrier Receiver unit can be expanded from the single ON/OFF arrangement used in our prototype. While the address decoding will be fixed for each receiver unit — as set by links LK1 to LK4 (address LSB to MSB) — the three command data bits appearing at Q1 to Q3 of IC3 can be used in a number of different ways.

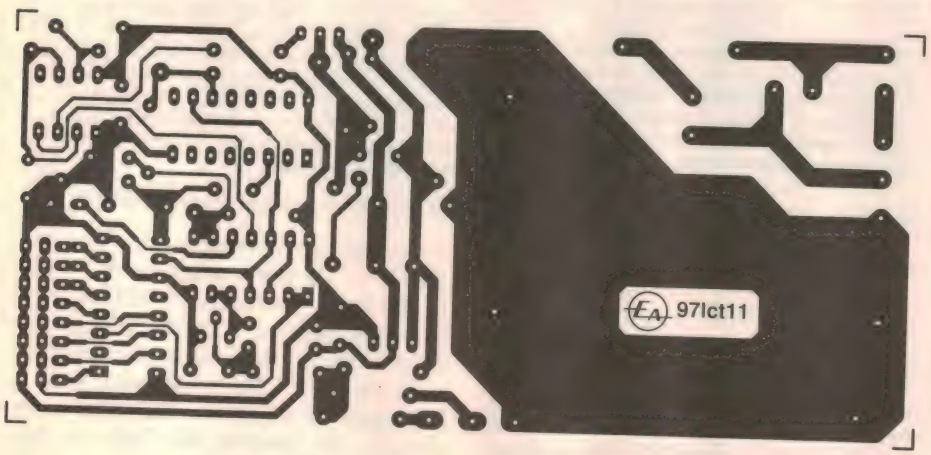
The first step in extracting the full eight possibilities from the three data lines is to pass the latter though some type of 3-to-8 decoder chip, such as a 74HC137, 4028 or similar. This results in the decimal version of the incoming command pattern, where the correct line will be high when the 'address valid' (AV) pulse appears at anode connections of D5 through to D9.

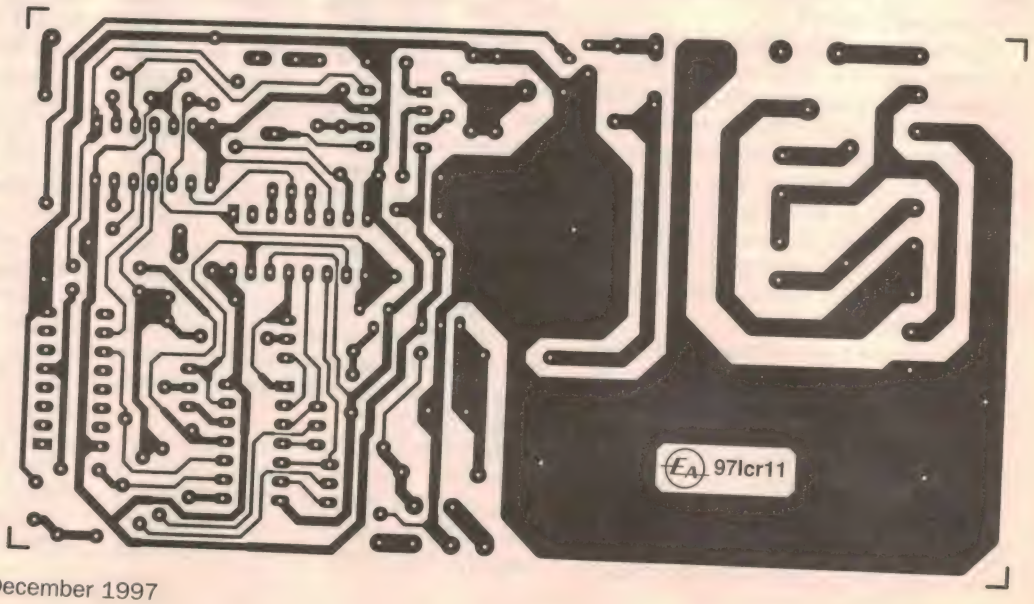
These lines can then be used in conjunction with the AV pulse to clock, toggle or latch the external circuitry needed for your particular application. Again, we are considering a number of circuits that perform this task, so that we can soon describe add-on boards for the Line Carrier Receiver unit.

If you wish to just expand the basic system used in our prototype receiver on the other hand, a further two D-type flipflops can be applied to the remaining raw command lines (Q0 and Q2 at IC3), without the need for a 3-to-8 decoder chip. This circuit duplication would result in *three* latched outputs, all of which could be applied to (say) mains-switching relays as before.

However, with this type of basic setup you need to be aware that all three flipflops will be updated when an AV pulse appears, so the transmitter coding system you use will need to take this into account. In short this means that if you just want to change the state of one of the three flipflops, the existing state for the other two will need to be reapplied at that time.

There are of course a number of other ways that the transmitter encoding and receiver decoding can be arranged in our Line Carrier Link system. While your own particular needs will really define the best approach and therefore circuit arrangement, we hope to publish number of small interface boards in the near future, for those who aren't in a position to develop their own. ❖





The PCB pattern shown above is the actual size artwork for the transmitter board, while the larger pattern on the right is that for the receiver unit.

AUTOMOTIVE ELECTRONICS

with JON LOUGHRON Assoc. Dip. Electronics

Toyota's TCCS engine management systems

This month we're taking a look at the TCCS engine management systems fitted to Toyota vehicles. These have a lot of similarities to other electronic systems, but there are differences — which are important to understand before you attempt to faultfind in these vehicles. Some of the key components can be located in unusual places, for example.

The early TCCS1 system is very similar to the Bosch L/LE Jetronic system. For those who don't know what the Bosch L/LE fuel injection system is, we will briefly revisit the basics.

The L/LE is a fuel injection system that has an air flow meter (AFM), coolant temperature sensor (CTS) and air temperature sensor (ATS), providing inputs to the electronic control module (ECM) to allow it to determine the optimum fuel injection 'on-time' in milliseconds for good emissions, maximum power and efficiency. Only the fuel delivery is controlled by the ECM; the ignition and idle system are controlled separately from the injection ECM. The ignition system provides the trigger for the fuel ECM, so there is no necessity for an extra crank angle sensor.

On the 'L' system, the fuel pump is controlled by a relay that is enabled by a set of contacts in the AFM; on the 'LE' the fuel pump is controlled directly from a tachometric relay (pins 30 and 87), which is triggered by the primary ignition signal.

TCCS fuel control

The early TCCS1 employs the same method of controlling the fuel pump. The circuit opening relay (fuel pump relay) is energised by a set of contacts inside the AFM, so when the engine is drawing air (running) the fuel pump is energised.

Because of the fluctuations in air flow during engine crank mode, there is another method of energising the relay and this is achieved by applying +12 volts from the crank circuit itself to another coil inside the circuit opening relay. This is only used during the crank mode and both circuits should be checked if fuel pump or fuel pressure problems exist (see Fig.1).

On most of the Toyotas, there is a check connector to enable the technician to retrieve fault codes and there is a fuel pump test pin in the check connector, so that the fuel pump can be run manually (check the wiring diagram for the vehicle that you are working on).

Remember that if the contacts in the AFM fail, **do not** hard wire the pump 'on'. The reason it was originally wired this way is a safety feature, ensuring that when the engine is stopped the fuel pump also stops. The EFI relay is located in the fuse panel in the engine bay and it is supplied +12V from the ignition switch. The connections are shown in Fig.2.

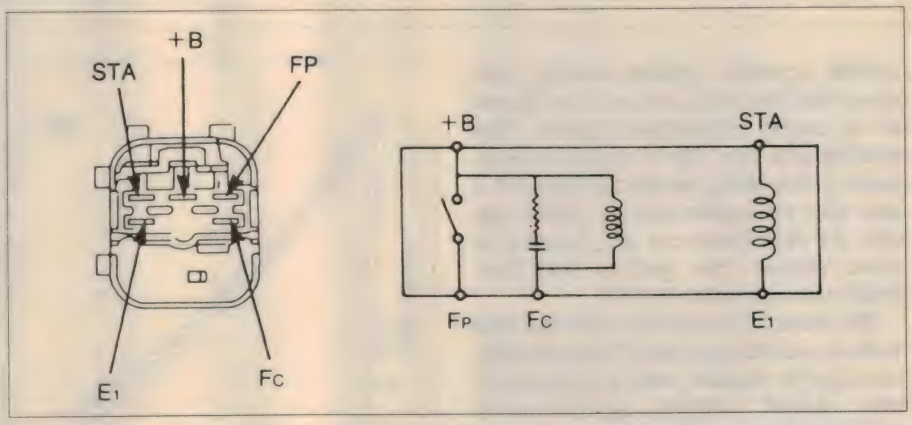


Fig.1: The circuit opening relay controls the fuel pump. Fc is earthed by the contacts in the AFM.

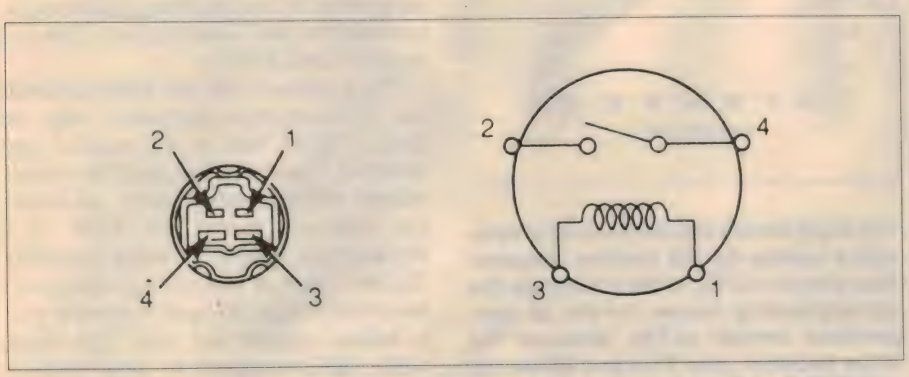
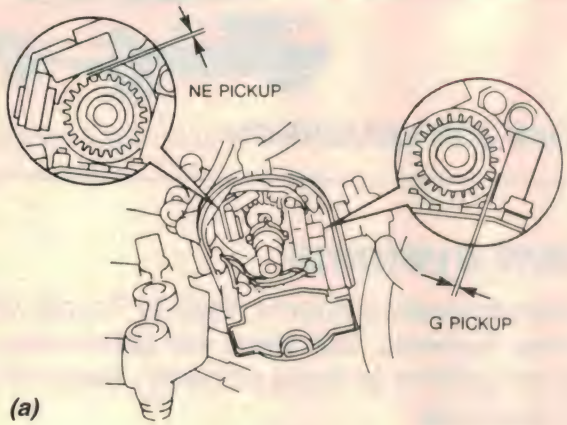


Fig.2: The main relay supplies power to the engine control module (ECM).

Trigger system

As mentioned previously the early TCCS1 system used the negative side of the coil to trigger the ECM trigger. Typical later model TCCS2, 3 and 4 systems employ 'G' and 'Ne' inductive pulse generators inside the distributor. I say 'typical' because the TCCS system may vary from model to model. An engine in a Camry may be similar to a Celica engine, but it may have different devices such as an external ignition coil and therefore a different distributor.

The ECM found on 1987-89 Camry



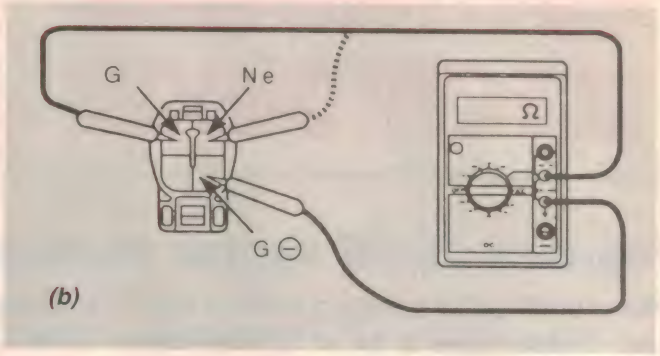


Fig.3: (a) shows the location of the 'Ne' and 'G' pickups, mounted inside the distributor. (b) shows the external connections to the distributor pickups.

models controls ignition timing, idle speed and fuel injection, so it is classed as an engine managment system. The distributor houses the G and Ne sensors and if you looking for the ignition coil it may take you some time — unless you take the distributor cap off, because in some vehicles the ignition coil lives inside the distributor as well.

The Ne and G outputs can be checked with an oscilloscope and if in doubt they can also be checked with a multimeter; they should measure approximately 140-180 ohms (see Fig.3b).

Some of the Toyota vehicles also have the ignition module inside the distributor as well, but the Camry has an external module.

The Toyota ignition system differs from most by having a feedback signal that informs the ECM that negative coil switching is occurring (Igf). The G and Ne pulse generators signal to the ECM what the engine position and speed is. The ECM then calculates ignition advance from the speed signal and information from the load signal (pin Vs) from the AFM.

The ECM generates a signal called 'Igt' (ignition trigger). This is a pulse, generated with advance/retard offset, and it is directly connected to the ignition module, which in turn switches the ignition coil. The ignition module generates the Igf feedback signal, derived from the negative side of the coil, to inform the ECM that coil switching and therefore spark is occurring.

The ECM will not switch current to the injectors if the Igf signal is not present. I do not know exactly why the system was designed this way, but it does make sense that if you have no spark occurring there is no need to inject fuel into the motor — which would only saturate the plugs and catalytic converter.

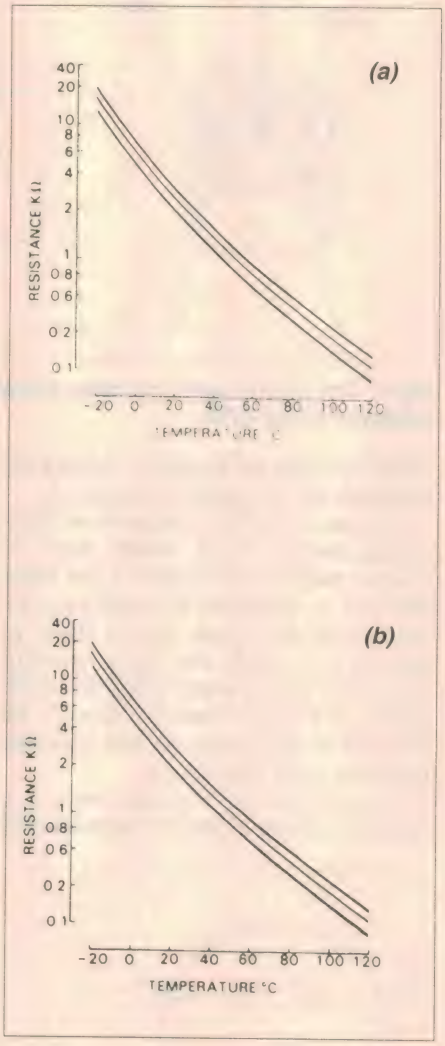


Fig.4: (a) shows the temperature/resistance curves for the coolant temperature sensor (CTS), while (b) shows the corresponding curves for the air temperature sensor (ATS). Measure the latter between pins THA and E2 on the AFM.

When testing the ignition system, ensure you have all power supplies intact and that the G, Ne, Igt and Igf signals are present and within specification. Test the ignition coil resistance and carry out all normal tests on the ignition system and remember modern vehicles have a fair amount of energy — so be careful. Remember that if you have no injection pulse, it may be due to the fact that you have no Igf signal.

Substitute coil

It is sometimes difficult to prove if the ignition coil (inside the distributor) is faulty. So for testing purposes only, I suggest that you temporarily connect a 'garden variety' high energy Bosch coil into the system. It won't work as a permanent replacement on the system, because physically it won't fit inside the distributor, but it will do for testing.

Another injection problem I have come across is when a motor transplant has been carried out on a 3SFE Camry, and after completion the vehicle would not start.

If you inspect the early and late model Camry diagrams you will notice that the early vehicle has injection ballast resistors and the later model hasn't. The end result is a dead ECM.

The problem with the transplant was the ECM/injector mismatch, and the correct ECM had to be sourced and installed. Once this was done the vehicle started and ran quite happily, so ensure the injectors match the ECM if a replacement engine is being installed. The two types of injectors have different resistance: those designed to work with a ballast resistor are only 1.6 ohms, while those designed to work without ballast resistors measure 16 ohms.

Standard EFI tests

The other EFI parts are relatively standard and testing can be done with a multimeter or scope. The AFM load voltage is measured on pin Vs and the supply is pin Vc (approximately 5V). Measure between Vs and E2 on the AFM; with the flap closed ensure that the voltage is approximately 4-5 volts, while with the plate fully open the voltage should be approximately 0.02 - 0.5V.

The coolant temperature sensor is an NTC (negative temperature coefficient) device, and therefore its resistance decreases with temperature. The air temperature sensor is also an NTC device and it is mounted inside the AFM; it can be measured between pins E2 and THA on the AFM. The temperature vs resistance curves for both devices curves are provided in Figs.4a and 4b.

Diagnostic codes

Diagnostic codes are available on this system. To get them out, flip the lid on the diagnostic connector and connect a temporary shorting lead between pins E1 and T (see Fig.5). The codes can be seen on the 'check engine' lamp on the dash.

Before attempting to retrieve the codes from the system, ensure the following conditions are satisfied:

- The TPS is closed (IDL-E1 measures 0.0 ohms)
- All accessories are off
- The engine is at normal operating temperature
- The transmission is in neutral
- The ignition switch is 'on'
- The battery voltage is above 11.0 volts

The check engine lamp will flash on and off for equal times if there are no codes — that is, 'system clear'. The diagnostic codes will blink at different intervals to the system clear flash, and the codes are listed below:

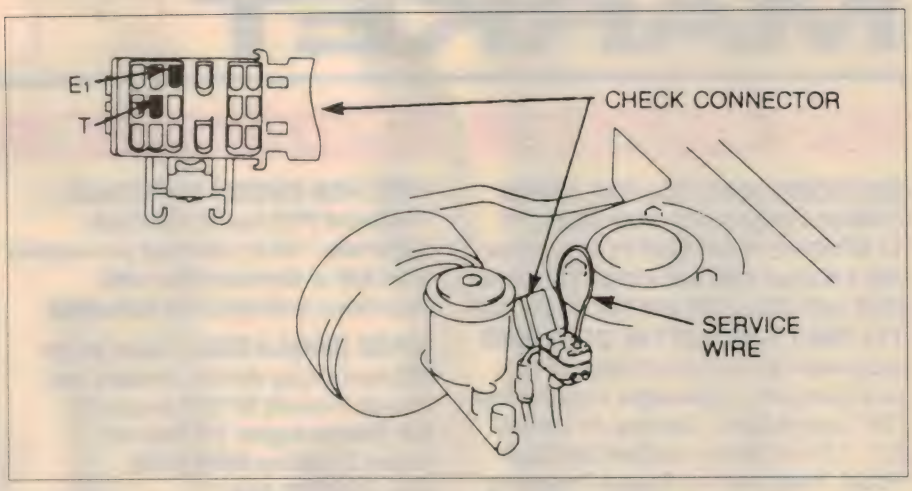


Fig.5: The diagnostic connector. Open the cover and connect a temporary shorting lead between pins E1 and T to get the diagnostic codes.

Code	Description
11	Possible ECM supply problem
12	No distributor signal (trigger) during crank
13	Intermittent distributor signal (trigger) failure
14	Ignition signal
22	Coolant Temperature Sensor
24	Intake Air Temperature Sensor
31	Air Flow Meter
32	Air Flow Meter
41	Throttle Position Sensor
42	Vehicle Speed Sensor
43	Starter signal
51	Switch input signal (i.e., air con, park/neutral etc.)

The codes are saved in memory (except 51) until they are physically erased. To erase them, disconnect the link between E1 and T in the diagnostic connector and then remove the EFI fuse for approximately one minute (ensure the ignition key is in the off position).

Removing the negative battery terminal will also erase the codes. So if the battery does need replacing, it may be wise to check if any codes have been stored in the ECM before replacing it (the battery).

Non starters

When testing a vehicle that has a non-start problem, the standard tests should be carried out. The first test is to ensure that the vehicle has fuel pressure and flow; once these have been proven to be within specification, check to ensure that the cold start injector and thermo-time switch operate correctly.

Check injection and spark, and as mentioned before if spark is not evident, remember that the injectors will not operate if Igf is not available. If there is no

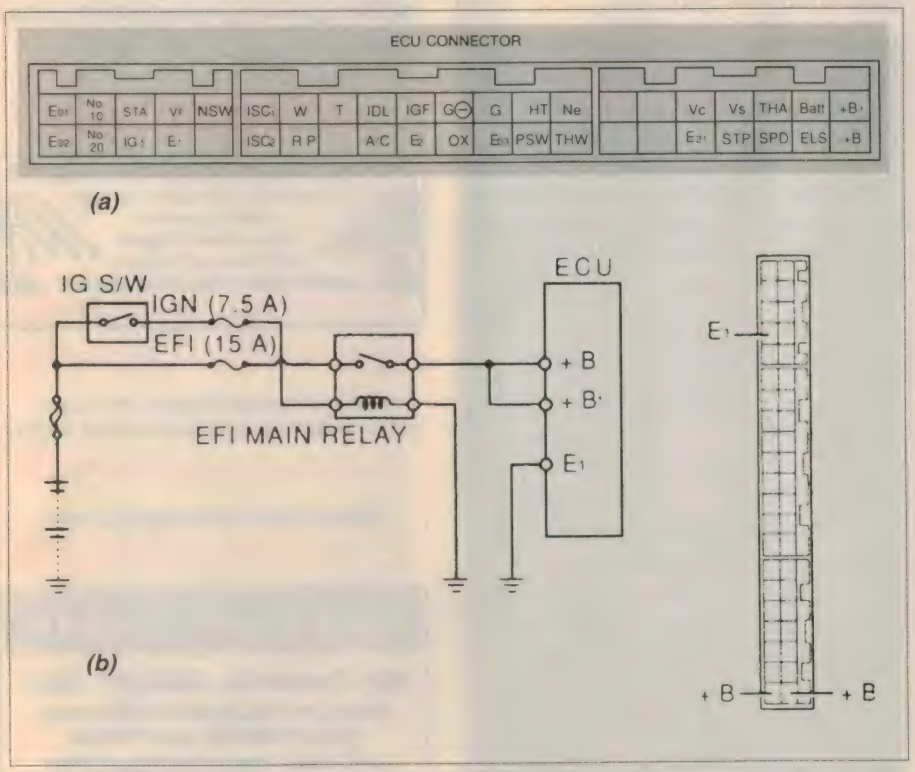


Fig.6: (a) shows the ECM connector pinouts, while (b) shows the basic ECM power supply circuitry. The ignition switch operates the EFI main relay, which switches power to the ECM.

(Continued on page 79)

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AUTO ELECTRONICS

(Continued from page 77)

spark or injection, check the power supply to the individual devices; if the power supplies are intact then check the system trigger to ensure that the G and Ne pulses are being generated from the distributor.

Fig.6a shows the pinout connections to the the ECM, to make it easier to check its power supply lines. Fig.6b shows the basic ECM power circuitry.

Heater core problems

Please keep in mind that all of the tests mentioned above are only guidelines when testing an EFI vehicle. It is important to do these tests before condemning the ECM, but it may also pay to check the ECM first in some instances because of where the ECM is physically located. On the Camry it is located directly beneath the heater core, in the middle of the dash under the console.

While I was in the middle of writing this article I was called out to a vehicle, a Toyota Camry, that had an intermittent stalling problem. After a quick inspection the reason became clear: the heater core was faulty and had leaked all over the ECM.

If the heater core fails quickly, this can be a bonus (apart from the expense) because often the ECM can be saved. On the other hand if it develops a slow leak and the owner is unaware that they are losing coolant, so the leak remains unattended, the coolant may get into the ECM — causing performance, starting and stalling problems. Eventually with water sitting in the ECM it may corrode the PCB and it may be unrepairable.

So for your customer's peace of mind, always check for coolant system problems by either doing a pressure test or checking under the dash where the ECM is mounted. Sometimes an indication of a slow leak from the heater core will be that the customer complains of the windscreen fogging internally, of damp carpets or a musty damp smell in the vehicle.

Well, that wraps it up for this month. I would like to thank the VACC technical department for their kind permission in allowing me to use the diagrams in this article.

If you do need information regarding modern EFI vehicles, the VACC has two very informative manuals. They are called the *Electronic Engine Management and Emissions Manual*, with the first edition Blue and the second White. The manuals cover Ford, GMH, Toyota, Mitsubishi, Mazda, Nissan and Honda. The manufacturers mentioned all have separate chapters that include various models — far too many to list here.

So if you are looking for some information targeting engine management systems, talk to the VACC bookshop or VACC technical department. Until next time, 'bye. ❖

NOTES & ERRATA

Audio Frequency Shifter (August 1997): The circuit diagram shows R53 as 10k, whereas it should be 100k as shown in the parts list. Also R41 (4.7k) is wrongly listed in the parts list as an extra R51. Lastly, R43 was not listed in the parts list at all; its value should be 3.9k.

RMS Current Monitor (May 1997): No pinout diagram was printed for the AD536 IC used in this project. This chip is supplied in a TO-100 package with its 10 leads arranged in a circle, rather than the 10-pin DIL outline on the PCB. Close inspection of the photo on page 58 of the May issue will show that the chip's pins are numbered anticlockwise (looking from the top) starting at the pin just after the tag, with pin 10 situated directly under the tag.

No Frills Active Antenna (October 1997): There is an error in the PCB pattern for this project, concerning the collector of Q2. As it stands, Q2's collector joins to the negative rail instead of the positive rail as shown in the schematic. To fix this, first isolate Q2's collector pad from the negative rail by cutting through the surrounding copper, and then use a short jumper to connect the collector to the positive rail. (The positive end of C8 is a convenient point.) Also, C9 should be 1.5nF, not 15nF as shown in the overlay diagram and parts list. In both cases, the schematic is correct. ❖

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INFORMATION CENTRE

by PETER PHILLIPS

Is there a future in servicing?

This month we present a circuit to solve a security light problem, discuss the electronics servicing industry, look at the practicalities of running long lengths of cable, and hark back to the March What?? question. There's also reader questions about a camera flash gun and the effect of the Earth's magnetic field on the convergence of a colour TV's picture tube — is it OK to move the set once it's set up?

While I don't claim to be an expert on VCRs, I know enough to get by. So when my five year old Sony model 777 VCR starting breaking tapes, I removed the covers, hoping I'd find a broken belt or similar. But this VCR was just too complex, and I soon realised I could do more harm than good, as apart from the instruction manual, I had no other information about it. Furthermore, its performance had deteriorated over the years, to the point where something had to be done.

So I took it to the local Sony agent, a guy I've known for some years, admitting that I didn't know what was wrong with it. He grinned, saying "You need two things to be a serviceman today — experience and resources."

As he went on explain, these days a serviceman is not only trained in electronics, but gets additional training from manufacturers. The workshop also gets backup from manufacturers, such as circuit manuals, alignment jigs, special tools, literature on typical faults and so on — things a home repairer usually can't get. And most important of all, a serviceman is continually getting the experience that is so vital to economically troubleshoot VCRs, TV sets, camcorders and so on.

After repairing my VCR, the proprietor showed me the problems that had caused the fault. The first was the switch-mode power supply, a plug-in module in which a number of electrolytic filter capacitors had become leaky. This is apparently a common fault with this model, but the construction of the supply makes the capacitors difficult to replace. So Sony now makes complete power supply modules available to service agents for around $60. Therefore, the first repair was simply to replace the module.

The second problem was rather more obscure, and one only an experienced serviceman would know. In this VCR, the guides in the metal base plate that supports the transport mechanism are lined with plastic. Plastic and metal expand and contract at different rates, and over the years the plastic linings had developed barely visible hairline cracks in several places.

The 'bumps' caused by these cracks were sufficient to randomly affect the alignment of each moving part of the mechanism. This had contributed to a 'buzzy' sound from the VCR (a hifi machine), to such an extent that it had for some time only been good for recording, and not for replay. The cure was to file away the bumps. Now, after repair, the machine is as good as new.

The cost of the repair was around $200, with most of this being for labour. But I had also paid for something else that is difficult to put a price on: the experience of the serviceman. Then there's the capital cost of setting up a fully resourced workshop, purchasing the necessary manuals and so on. If you add up the hours that go into developing the expertise needed by a serviceman, and the cost of maintaining a workshop, it seems a bargain price.

If I had tried to fix the VCR myself, it would have taken me many hours of research — time I'm better off spending on earning an income doing the things I am experienced in. Still, it's sobering to realise that despite many years in the field, I'm now in a similar position to most of the community — I need to get someone else to fix my electronic equipment. So, if you're in a similar position, don't feel bad about it. It's progress!

Having opened with a servicing story, let's briefly talk about the service industry, and where it's heading.

The service industry

It's likely you've read some of the gloomy stories about the service industry, in this and other magazines. Common complaints are the 'backyarder' who offers cut-throat rates, the fact that people now *replace* rather than repair faulty equipment, the high reliability of modern equipment and so on. The service industry has always been rather precarious, but it's not all doom and gloom. The following letter is from a reader who has recognised a need and is providing a service that appears to be in demand:

I read with interest the letters about computer gripes that appear in your column. This is because I have been watching the computer industry for the past six or seven years and have now been actively involved in it for nearly three years. Currently I am running a business from home as a computer consultant, because I saw a real need for home users to have somewhere to go when they have a problem with their computer.

A joke: "How many computer programmers does it take to change a light bulb? ...That's a hardware problem". Sadly, this describes the attitude, in most instances, of computer suppliers or software companies. This is often because of the cut-throat pricing in the industry, meaning that companies need as little overhead as possible. Even Microsoft, the largest software supplier, is charging for support.

As a freelance consultant I provide a

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service to both companies and individuals, in hardware and software, solving conflicts, failures, configuration or setup problems. I also offer advice about which computer system to buy, and which software suits the particular needs of people. I also take up issues with suppliers on a customer's behalf, as I have found that when told of the problem in technical terms, the supplier usually gives in and helps the customer.

The fact that my business is successful obviously shows that people aren't getting the support they need from both software and hardware vendors. It's this problem that I now provide a service for.

You are probably wondering how much I charge, thinking it's probably $70 an hour or more. These prices are justified in some areas of consulting for companies, but not for individuals, who usually can't afford it. Instead, my charge to individuals is $30 an hour, making me affordable to most people.

Other services I provide are custom database design, Web page design, training (both individual and group) and small volume sales (hardware and software). These give normal users, who view computers as a tool to get the job done, the resources to complete their job. (Conrad Smith, CSCT Technologies, Berowra, NSW)

Good on you, Conrad — the industry needs people like you who can interface in a technical way between customers and suppliers. As I've said in the column before, the computer industry is a tough one, and its complexity often means consumers end up with a raw deal. So congratulations on seeing a need and setting up a business to deal with it.

I'm particularly interested in the rates you charge. An old saying in business is to charge what customers will pay, but some companies seem to take this rather too literally. You might get one job from a customer at $70 an hour, but at $30 an hour you will most likely get more jobs from each customer, who will tell others of your reasonable rates.

Cost has always been a factor in servicing, which explains why many people replace rather than repair faulty equipment. There's probably not a lot the industry can do about this, as equipment serviceability is becoming increasingly more difficult, and therefore repairs more expensive. This means customers often have no alternative but to replace faulty equipment.

But there's also the problem of the unscrupulous serviceman who charges $200 to replace a fuse. To me, this is a far greater problem to the service industry than the 'backyarder'. After all, backyarders often repair equipment a customer regards as not worth taking to a service centre. And sometimes a backyarder will refer a customer to a service centre, a job that centre might otherwise not have been given.

And when you think about it, repair is only one aspect of the consumer electronics market. As Conrad points out, acting on behalf of a customer to a supplier, providing advice and related services are others.

Perhaps one of the most important things a customer looks for today is the quality of the service. The service centre that repaired my Sony VCR had posters around the wall saying things like 'It takes months to find a customer, seconds to lose one'. While these might seem gratuitous, I felt encouraged. The proof came when the VCR was repaired properly and within the timeframe we agreed on.

This company has a staff of five or so, and the owner himself deals with customers, rather than relegating this task to a secretary. The company has a computer installation that allows all technicians to see the progress of any job, so if the owner is away, any employee can help a customer. It's this type of service that today's consumers want.

It seems to me that these days, success in the electronics servicing industry lies in being efficient, entrepreneurial, giving quality service, keeping costs to a reasonable level, being honest and looking after customers. And most importantly, looking out for unmet needs, like those mentioned by Conrad.

I hope people from the servicing industry will write to me about this topic, perhaps with a few suggestions on how to make a good living from it. After all, we all want the industry to prosper.

Security light problem

I've had a number of letters in reply to a question in the August edition regarding power supply interruptions and their effect on sensor-operated security lights. The problem is, you might recall, that the lights switch on and stay on if the mains supply is interrupted for two seconds or less. While no one has sent me information about modifying the lights, the following letter gives details of a simple circuit to interface between the supply and the lights. This circuit, according to our contributor, will solve the problem. Most of those who wrote to me about this problem suggested a circuit along these lines, although this is the only actual circuit I received...

I enjoy your column and thought I would for once give some input. To stop the security lights locking on from brief supply interruptions, it seems reasonable to hold the supply off for sufficient time to defeat the problem.

I have drawn up, wired and tried the attached circuit on a load of three 100W lights fitted around the house (with individual sensors).

My only problem from power interruptions (which are rare here) used to be the TV; on restoring supply it would switch itself on, with full volume and on an unprogrammed channel — a bit disconcerting when you return home from shopping, etc.

To overcome this I installed a relay fed from the mains through a capacitor

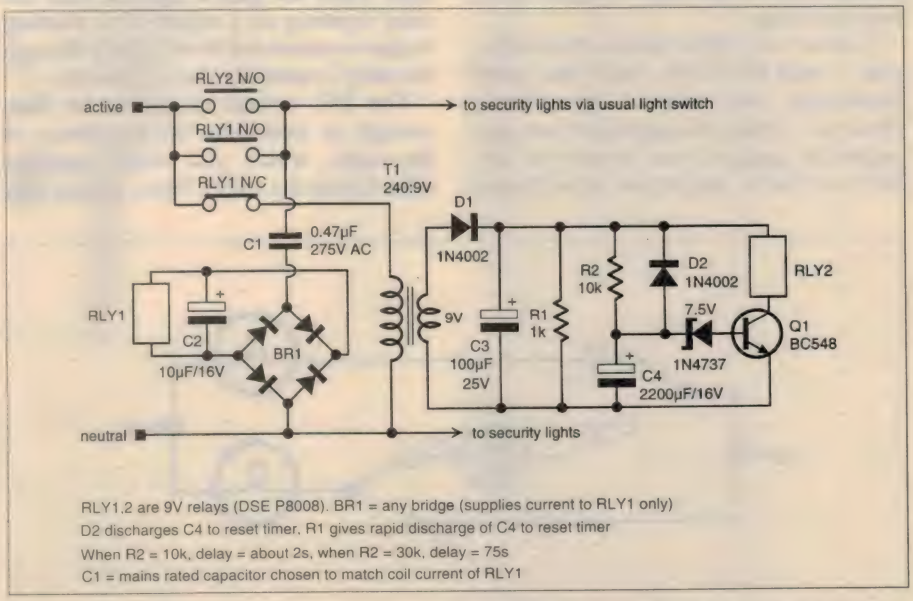

Fig.1: Sent in by a contributor, this circuit introduces a time delay to stop sensor lights staying on after a short power interruption.

and bridge rectifier (as in RLY1 of the attached circuit), with a reset button on its supply side. All this fitted in a case similar to a surge protector with a piggy-back plug. It is quite neat, it has been in use for several years now. I hope this response will help your readers. (Trevor Murray, East Maitland, NSW)

Thank you for your circuit, Trevor; I've reproduced it in Fig.1. As Trevor explains in his letter, in the event of a power failure, RLY1 opens instantly. On supply restoration, timing relay RLY2 closes after a preset time and initiates RLY1, which latches on, isolating power from the timer circuit. Timing capacitor C4 is then rapidly discharged through D2 and R1, ready for the next event.

Trevor also points out that the relays (available from Dick Smith Electronics, as P-8008) have a limited load capacity of around 300 watts. If heavier loading is intended, replace RLY1 and its associated supply (C1, C2, BR1) with a 240V AC contactor or relay of whatever capacity suits, using the contactor or relay contacts to supply the load, and its auxiliary contacts as RLY1 N/O and N/C.

Remote gate

Referring again to the August column, the next letter suggests a simple way of telling if a gate located some 500 metres away from the house has been opened:

Like your August correspondent, I live on a rural block where the house is a long way from the boundary gate. So the question of a gate-open signal is of interest to me.

I know very little about electronics, and I read EA in the hope that some knowledge will soak in by osmosis. However, I think the approach you suggested in August is too hi-tech for me. Why not run a single-core wire from a suitable voltage in the house, arranged so that when the gate is opened, the wire is connected to earth and current flows — you get the picture, I'm sure.

The wire would cost a bit, perhaps $100 or so, and there might need to be some clever bits added to take care of the capacitance and resistance of the wire. But I reckon it would work, and you don't need a solar panel or a battery. (Frank Murphy, Temagog, NSW)

The original question was about a sensor to detect someone passing through an open gate, rather than indicating if the gate had been opened. But let's look at your idea Frank, as although it doesn't solve the original problem, it might solve yours.

The main problems of running a wire over a length of 500m or more are the expense and the practical difficulties. Your idea of using the actual ground as a return has a few problems. As any supply authority will tell you, the earth is not a reliable conductor, particularly if the soil is sandy and dry. While there are methods of using the ground as one plate of a capacitor, again reliability is a factor.

So if you are happy to run one wire, I suggest you instead run two, such as twin phone wire. You'd need a suitable DC supply connected in series with a relay, which in turn is in series with the gate contacts. When the contacts close (gate opened), the relay operates, sounding a buzzer or whatever. Alternatively, for a fail-safe circuit, connect it so the contacts open when the gate is opened, with the relay opening as a result. The warning buzzer is connected to the supply through the relay's normally closed contacts.

The DC voltage needs to be high enough to overcome the resistance of the cable, which you would measure after laying the cable. From a table that details the specifications of coil winding wire, I figure that typical telephone wire has a resistance of around 100 ohms per kilometre. So if the relay coil takes 100mA, the voltage drop across the cable is 10V. For a 12V relay, you'd need a supply of around 20V. The actual voltage will obviously depend on the current taken by the relay coil.

That deals with the circuit, but the main problem I see is laying the cable. If you dig a trench, you really need to run the cable in protective conduit, or to dig the trench deep enough so it's adequately protected. Stringing it on poles is another way, but I doubt if you want to go to that extent.

Overcoming the need to run a cable is where things become more technical. There are various ways of sending a signal over a distance of 500m, but all of these need a solar panel and battery system to power the transmitter at the gate. So I guess it's really a question of whether you run a cable or get involved in other means of sending a signal between the gate and the house. Either way has its problems.

Camera flash gun

Our next letter asks about the identity of a device in a commercial electronic flash gun.

I have a Hanimex K400 electronic flash gun, and the semiconductor installed in the housing of the hot shoe connection is defective. I'm not sure what this device is, but I suspect it's an SCR. It is marked M21C, has a TO-92 case and three terminals. However I cannot find any reference to it in my data books. I want to repair the flash gun, as it otherwise works well. Could you tell me what this device is? (John Nairn, Leongatha, Vic)

Unfortunately, although I have quite a few data books John, none lists this device. I found an M20 and M22 (both are diodes), but nothing even like an M21C.

I agree that the device is most likely an SCR, but most TO-92 SCRs that I know of are 100V rated or less. A flash gun usually operates at 200V or so, although it's not essential for the trigger device to operate from this voltage.

A circuit that might help you is the Xenon tube flashing beacon, in the November '95 issue of *EA*. It might help you trace out the circuit of your gun, and perhaps establish the voltage requirements of the unknown device. Or perhaps a reader can help.

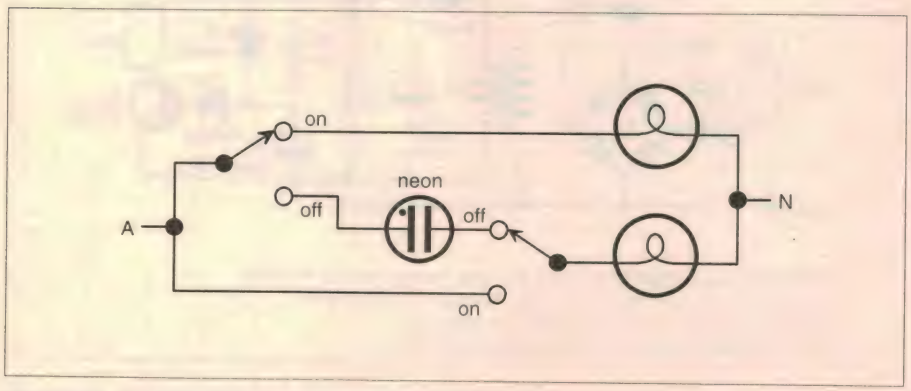

Fig.2: The original answer to the March What?? question.

TV sets & magnetism

The following extract from the *Sunday Telegraph*, September '97 was sent to me by a reader:

If you're buying a new TV set, check that the picture tube has been tuned for Australian conditions. The Earth's magnetic field is strong enough to affect the registration of the red, green and blue primary colours that produce the many natural hues on the screen.

The tubes can be optimised for the southern hemisphere, but experts admit that up to 70 per cent of those made are tuned for the northern hemisphere.

Our correspondent asks:

Is this rubbish, or is there something in it? Perhaps manufacturers should optimise their sets for those who have their TVs facing, north, south, west or whatever. (Bruce Harris, Malabar, NSW)

Yes, there is something in this, Bruce. Early colour sets always had a vast array of controls to adjust the convergence of the beams in a colour picture tube. (Convergence means setting the three beams so they strike all points of the tube with the correct registration.) Owners were usually advised that the Earth's magnetic field would upset the adjustments, meaning the set should be left in the position it was when the convergence settings were done.

These days, colour tubes come complete with the deflection yoke, and convergence is done in the factory. Most modern sets don't even have convergence adjustments, other than a few permanent magnets around the tube. Therefore it's reasonable to assume that a lot of tubes would be set up for the northern hemisphere.

However, two things come to mind: would a salesman be honest enough to tell you what hemisphere the set was adjusted for, assuming he/she knew, and does it matter much anyway? Convergence is always a compromise, with the convergence around the edges of the tube sacrificed for best adjustment in the centre. I've never yet seen a tube with accurate convergence over all parts of the screen.

I think you'll find that modern TV picture tubes have better convergence than ever before, and moving it from one hemisphere to another will make no discernible difference. Still, I'm interested in what readers might have to say about this.

March's What??

Quite a few readers seem to visit the local library to read *EA*, which explains why this letter is referring back to the What?? question from March. To refresh your memory, here's the question again:

You have two floodlights in the garden, individually controlled by two switches in the house. Because these lights are often inadvertently left on all night, you decide to fit a neon pilot light to the switch panel to show if either one, or both lights are on.

You only have one neon lamp, and because a double-pole switch is too expensive (and hard to get) you need to use the existing single pole, double throw switches that control the garden lights. You cannot use any other components (relays etc) as there's no room behind the switch panel. What is the circuit to achieve this?

The answer we gave is shown in Fig.2. Remember that the neon is off when either one or both garden lights are on, and on when both lights are off. But as the following letter explains, there's another, better way...

Browsing through back issues of EA at the local library, I came across the switching question in March, then the answer in April. While the answer you gave certainly works, it has some drawbacks. In the first place, it relies on the neon current flowing through the filament of one of the lamps. If that lamp is blown, the neon won't light. Furthermore, although unlikely to be a problem, the current flowing through the neon, and therefore through the filament of the garden light could shorten the life of the light. Nit picking, but possible.

My circuit overcomes the above limitations, which I'm sending to you on the assumption you are after the best answer. Incidentally, keep up the good work, your column not only informs, but also educates by virtue of the wide range of subject matter. After all, isn't variety supposed to be the spice of life? (Jim Thornton, Palm Beach, Qld).

Thanks for your supportive comments, Jim. We certainly have variety, thanks to our readers. I've reproduced Jim's circuit in Fig.3, which as you can see doesn't rely on the neon current having a path through a lamp filament. By the way, assume there's a suitable dropping resistor in series with the neon indicator. This is usually built into the body of a typical indicator, as without it the current through the neon lamp will be very high.

Jim's letter is fortuituous, as it leads nicely to this month's What?? question, which is also about switching lights.

What??

The question this month comes from an actual experience, related to me by Rob Evans, *EA's* technical editor. It goes like this...

I was asked by a friend to solve a problem with a two-way lighting circuit. My friend had asked a local plumber(!) to fit a light dimmer to the circuit. After doing so, the dimmer worked perfectly, and the switch at the dimmer switched the light on and off as you'd expect. However, the second light switch in the circuit now no longer did anything, and had no effect on the operation of the switch at the dimmer. I looked at the wiring, and all seemed to be in order. What had the plumber done?

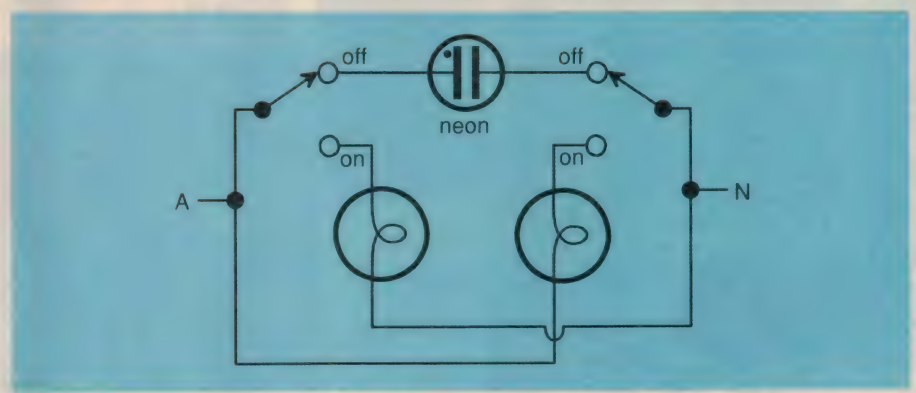

Fig.3: An alternative answer to the March What?? question, in which the neon indicator current doesn't flow through either lamp filament.

Answer to November's What

Starting with terminal B, because R3 = R4, the voltage at the non-inverting input is 1V. Therefore the voltage at the inverting input is also 1V. Because there's 1V at both ends of R1, no current flows (as there's no voltage drop across R1). Therefore the impedance looking into terminal A is infinite (assuming a perfect op-amp). The impedance looking into terminal B must be R3 + R4 as there's 1V across both resistors. That is, the full 2V at terminal B appears across both resistors in series. ❖

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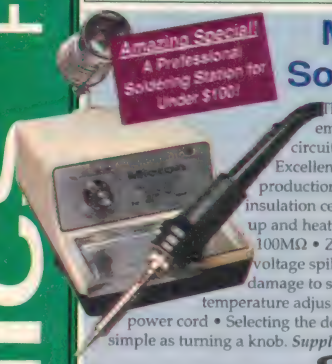

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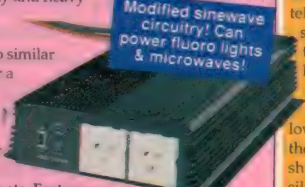
Modified sinewave circuitry! Can power fluoro lights & microwaves!



This inverter provides up to a massive *1500W* of 240V power from a heavy duty 12VDC car or truck battery. Switchmode circuitry eliminates bulky and heavy output transformers, making this unit very lightweight compared to similar inverters. It's suitable for a wide range of applications such as remote homes, sail & power boats, building or mine sites, off road vehicles, caravans, farms etc. **Features:**

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This amazing inverter provides up to 125W of 240V AC power from your car cigarette lighter socket! During our testing, it ran our entire A/V room setup, including a huge 68cm television and surround sound amp! Can power televisions, VCR's, lights, small battery chargers, shavers and hi-fi systems. Features low battery indicator, thermal & overload shutdown and is totally silent when operating. Built-in 3-pin plug (no adaptor required). Includes car cigarette lighter socket lead.

"There are quite a few different 12V to 240V inverters on the market, but few are as compact and as neatly packaged as this one" *Silicon Chip, April '97*

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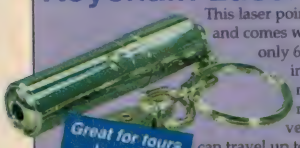

Great for tours, lectures, seminars etc!

This laser pointer weighs only 45g, and comes with a keychain. At only 61mm long by 14mm in diameter, it's not much bigger than many keys! It emits a very intense beam that can travel up to 50m, and projects a bright red dot onto the target is it aimed at. It's ideal for lectures, guided tours, seminars, building sites etc, and it's much less intrusive than a normal stick pointer! Uses two button batteries (included).

A 0201 WAS $69, NOW **$49**

Hi-Power Siren

HUGE 120dB Output! Great for car & house security systems or alarm panels!

Strong & durable construction, makes this siren ideal for car, boat or home installation. Includes a handy bracket for surface mounting. **Extremely loud 120dB output.** Requires 12V DC @ 300mA. Dimensions 100Ø x 125L mm.

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T 2446 **$49**

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Audio Masker Kit

Relieve the irritating symptoms of tinnitus with this simple audio masker!

(See EA Dec '97) An audio masker is a form of white noise generator. It's used to mask the noises heard by people suffering from tinnitus. Tinnitus is a common problem that can manifest its self in many ways , from a low level roaring to a constant ringing in the ear. This device "masks" these sounds by emitting a continuous noise (such as that of a rushing waterfall), which the brain can isolate more easily. It's much cheaper than commercially available units (some run to $800 each). It features adjustable level and degree of noise filtering. Powered from a 9V battery (not supplied), and comes complete with a silk screened case.

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T 1552 Plus T 1522 ONLY **$54**

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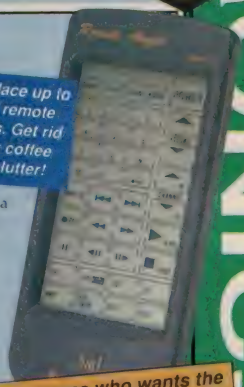
with Backlit Screen



Can replace up to EIGHT remote controls. Get rid of your coffee table clutter!

Sick of having remote controls all over the coffee table? Always picking up the wrong one? This *learning* remote control can replace up to eight remotes! It features a multi-function *touch sensitive backlit LCD* screen. With 8 different appliance modes, it can control a TV, VCR, CD, LD, AMP, TAPE/TUNER, and has auxiliary modes SEL1 and SEL2, which can be custom configured. When you select a mode, the unit changes the buttons on the display to mirror the controls of the selected device. AMP mode includes Surround Sound effects adjustment button (centre, rear, surround etc). The unit is programmed from an original remote, which must be in working order, and a macro function allows one button to perform up to ten sequential tasks. Also features backlighting (unlike others on the market) which is essential at night or when the curtains are drawn. The backlighting is light sensitive, so it only activates in rooms with low light levels, saving batteries. Requires 4 x AAA batteries (supplied). *BEWARE OF NON-BACKLIT VERSIONS WHICH ARE USELESS IN DARK ROOMS!!*

"For anyone who wants the ultimate remote control, this has to be the one." Product Showcase, Silicon Chip Magazine May '97

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At last! A useful digital tacho with super-fast update time and 1 rpm resolution!

(See EA Oct '97) A great high-tech addition to your car's dashboard! This 5 digit tachometer features a crystal timebase for super-accurate readings, a 0.25 second update time and a resolution of ONE rpm. It also has a dimmable display, leading zero blanking, last digit "0" lock (stops "rolling" display), and can read to 60,000rpm if required. Not even rotaries rev *that* high! Can be configured for ignition coil input (3V) or low level input (1V) from an existing tacho. If you're after a *useable* digital tacho for street or circuit applications, this is it! *Note: Case NOT included.*

K 4325 **$79**

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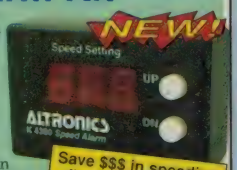


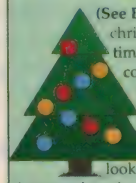
NEW!

Save $$$ in speeding fines and possibly your license with this audible and visual overspeed alarm!

(See SC Dec '97) *The best way to reduce the number of speeding fines you receive each year is to simply avoid speeding!* This kit lets you know when you're speeding by emitting an alarm and flashing an LED located on the dashboard of your car. The alarm point is adjustable in increments of 5 kph from 0 to 155 kph. You'll know you are speeding without taking your eyes off the road for a second. It consists of two sections, a dash mounted control panel which features a 3 digit display to indicate set speed, and a main box (not shown) housing most of the circuitry, which can be located under a seat or dashboard. A single trimpot is used to calibrate the unit to your existing speedometer. Kit comes complete with screened & punched cases and magnetic speed pickup, and is powered by 12V DC.

K 4390 **$72**

Santa's Christmas Lights Kit



Spruce up your Christmas tree with these inexpensive but super effective lights!

(See EA Dec '97) Are you sick of those collections of christmas lights blowing globes every time they are used? This project consists of five strings of six super bright LED's that flash in a random pattern for a great christmasy effect! This project allows you to customise the flash rate to get the look you want. It's inexpensive, simple to construct, and adding more lights to the circuit is very simple. Comes complete with LEDs and silk screened case. Powered from a 12V AC 500mA plug pack, so it's safe around children.

K 1150 **$24.95**

NEW!

M 9666 12V AC 500mA Plugpack **$14.50**

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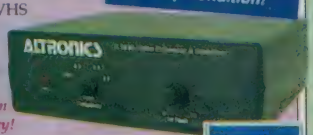

(See EA, Nov '97) Ever transferred your home or holiday movies to VHS and found the picture quality is degraded? This little enhancer will spruce up the video signal, and can even improve the quality of poorly-recorded video. It also has an image stabiliser which removes all the invisible overheads from video signals, such as teletext data, leaving a clean PAL composite signal. *If you're into making your own movies or taking some holiday footage, this is a very useful accessory!*

K 5830 **$59**

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Dec '97 244

Moffat's Madhouse...

by TOM MOFFAT

Going digital, reluctantly

After many years out of the service business, I have suddenly found myself back it it, in a big way. My last contact with front-line electronic service was back in the seventies, in Tasmania, doing two-way radio work for Motorola. I had one very flashy workshop, equipped with top-of-the-range test equipment from makers like Hewlett-Packard and Systron Donner. Back then Motorola demanded that their maintenance people have the right gear to do first-class work, a policy in keeping with the fine quality of their products.

Unfortunately I had to withdraw from the Motorola scene rather quickly when the Australian government suddenly devalued the Aussie dollar, and imported US radio equipment suddenly copped a price rise of around 30%. No new radios meant no new warranty work, and at that very moment a good job came up in television news. So I was off...

Motorola graciously offered to buy my test gear. After that dollar devaluation, stuff from companies like Hewlett-Packard shot through the roof, so the used prices rose as well. I ended up selling all that gear for more than I had paid for it, but with it went my ability to do professional-grade servicing.

A few years later I quietly slipped back into electronics again, this time designing computer-driven educational robots, as well as the microcomputers themselves. This evolved into the Navimate weather-fax products, which in turn became the basis of the Listening Post and Wesat projects in *Electronics Australia*.

All this activity needed some test equipment, but since radio frequencies were no longer involved, things could be a little simpler — a nice Japanese analog multimeter, and a BWD Australian-made CRO, both of which I still own to this very day.

Moving forward in time again, to Port Townsend, Washington: for the past few months I've been doing computer consulting, and developing a reputation of being able to handle the 'hard ones'. One day, standing around outside the Community Center listening to a band play, I'm approached by a musician friend who also owns a music store: "Tom, do you think you can do electronic keyboards, and guitar amplifiers, and ... and... You know, some of this stuff has got TOOBS!"

Well, there you go — one of the advantages of being an oldie. Young techs had come and gone from this music shop; they'd been all right with the solid-state stuff, fixing dirty pots and jacks and cables. But when a valve-based amp came along, they would bluster their way through it, running up hours of labour time, but getting nowhere. After this happened to the music shop a few times, I suddenly found myself service manager.

Again, a test-equipment shortage. I have my multimeter with me, but the CRO is still back in Tasmania. You don't need much to fix computers, since you seldom get right down to the board level. Most of their problems are things like interrupt conflicts, diagnosed by special software. So I can do just about any computer job with a few floppy disks and a Phillips screwdriver...

In the music store, I pressed on regardless, fixing jacks and replacing pots and diagnosing amplifier faults with the 'blap test', in which you put your finger on the input of a stage and induced mains hum causes a loud 'blap' from the speaker if the stage is working. The blap test served me well, until the day the store owner came into the workshop lugging an enormous guitar amp that he had been 'hiding' until I proved myself. "OK Tom, let's see what you can do with THIS one..."

'This one' had been from service shop to service shop, from tech to tech, and was now declared unfixable. It had been given to its current owner, who was told, "if somebody can fix it, you can have it for nothing". The new owner had put a $150 limit on the repair; if it was going to cost more than that, then the amplifier would go to the scrap-heap.

I got the feeling that if I too failed with this guitar amp, then I'd be out on my ear as well. And if I spent more than three hours on it, it would go past the price limit, and if I still couldn't fix it, my fees would be waived.

With that cloud hanging over my head I fired up the amp. A gentle hum, nothing more. So far, so good. But when I plugged a guitar into it, the amplifier erupted into 100 watts of hissing and shrieking, rattling the floor and the workbench, even surpassing the girl who was learning to play the clarinet in the teaching room next door.

It was obvious the blap test would be useless here, because this amplifier was doing plenty of blapping on its own — without me needing to tickle it with a finger. So I fell back to plan B, a wholesale cleaning of all pots and jacks. It was totally unsuccessful. The first hour shot to pieces and no progress at all...

Then I noticed something odd, and I called out to the store owner, who knew a lot more about guitar amplifiers than I did. "What do you think this is, George?"

"Looks like a tube socket to me", he said.

How silly, I thought. I'll bet it's a connector for some optional effects unit or something. But George took the direct approach. "Let's plug in a tube and see what happens." So we plugged in a 12AX7, and it lit up!

How very strange. This was obviously a solid-state amplifier. In the front end there were several eight-pin IC's which were clearly dual op-amps. And at the other end were some healthy-looking power transistors. To me, this means solid-state. Yet... here was this tube! And it was glowing!

Installing the 12AX7 meant there was now a signal path through the amplifier, and plugging in a guitar now produced some weak notes along with all the blapping and shrieking and hissing. Something was still very, very wrong.

The clock was clicking away, so we decided to put the amp back on the shelf

for a while. Two things had to be done: I badly needed a circuit diagram, and even worse, I needed an oscilloscope.

The amplifier's manufacturer was cooperative, and agreed to fax us a circuit. Soon we had a nice fax of the board layout. That was nice to have, but it was not the circuit, so I asked the manufacturer once again. And got another copy of the board layout. It took two more goes to finally find someone who knew what a circuit diagram actually *was*, as opposed to a board layout.

My BWD CRO back in Tasmania wasn't going to do me much good; as well it was over 15 years old, so I decided to buy a new one. I had always lusted after one of those Fluke ScopeMeters, and now I had my excuse to buy one. So I started searching the Internet to see who sold ScopeMeters, and for how much. I soon discovered that Tektronix sold similar gadgets, called TekMeters.

Never having even seen either one of these, I decided it might be prudent to ask someone who had, and the most likely person I could think of was Jim Rowe, *EA*'s Editor. So I e-mailed Jim and asked which I should buy. His answer — neither, since they were limited in scope, so to speak. Jim said I should get a REAL oscilloscope, the Tektronix TDS210, which he had reviewed in November last year. This was a full-blown digital oscilloscope; not an analog bone in its body.

Reading Jim's review, plus more digging on the Internet, convinced me that this thing could actually work. It has an LCD screen, just like on a small laptop computer. There is no cathode ray beam to write wildly moving patterns on a green phosphorescent screen; instead the oscilloscope circuitry has to figure out which pixel to activate, and which one to do next, and then write wildly moving patterns on the screen. This means the little guy inside who does the digitizing would have to pedal pretty fast.

The Tektronix digital CRO (wrong! no cathode rays!) — sorry, oscilloscope — was priced about halfway between the two Scope/Tek Meters, so I took the plunge and ordered one. A cool thousand bucks on the Visa card. Three days later, as promised, it turned up and I began learning about digital oscilloscopes.

Obvious difference

The most obvious difference between the digital oscilloscope and its analog brother is the lack of a CRT, a long and heavy and fragile thing. So the digital version looks more like a small TV set than an oscilloscope. And despite its digital nature, the Tektronix has KNOBS where knobs ought to be, as sensitivity controls for the two vertical channels, and the horizontal sweep control. This is obviously a concession to people brought up on analog oscilloscopes.

But these knobs are not real switches; instead they click round and round in endless circles. They are obviously optical choppers or something similar that send pulses as their output, and the digital goodies do the rest. Hence there are no labels around the knobs; instead their settings are shown as numbers on the screen. I found this a little disconcerting at first, but soon got used to it.

So on Day One I fiddled with the square wave calibrator, and put a finger on the probe to look at the mains hum display (a blap test), and eventually connected the scope to a small radio to see moving audio waveforms. And, well, it LOOKED like an oscilloscope. So it must be one.

Soon it was time to tackle that horrible guitar amplifier again. I had run out of excuses to delay any further. So me and my new oscilloscope went into battle. With the help of the long-awaited diagram it was easy to trace through the circuit. Very interesting: two stages of op-amps, then two stages of 12AX7 tube, then two more stages of op-amp. Why? Because this thing had been sold as a TUBE AMPLIFIER, and sure enough, it had a tube: one tube! How did this one tube improve this amplifier's sound? That's debatable.

As for our little fault, Mr Tektronix' Digital Oscilloscope quickly spilled the beans. The whole of that amplifier, every single bit of it, was in lusty oscillation at supersonic frequencies. Working through the stages, I glanced at the scope signal, reached over and reduced the sensitivity, moved to the next stage, reduced the scope gain again — and suddenly realized I had completely forgotten it was a digital instrument. I was operating it exactly as an analog instrument, yet it synched up on just about anything. The best of both worlds, and it certainly has my stamp of approval now.

All this signal tracing, from the input toward the output, and from the output back toward the input, kept pointing to one area in the middle: a section containing a spring reverb unit, driven by one op-amp, with its springy-noises being received by another op-amp. Oscillation here was particularly violent, and when I reached over and disconnected the reverb unit's input, the amplifier went into spasms of motorboating — slow, thumping, intense oscillation, nicely displayed on the oscilloscope.

Gotcha! Problem solved. There were four Utilux-style spade connectors arranged in a square on the circuit board. These went to shielded leads to and from the reverb unit — ground and signal out, ground and signal back in. During a previous repair attempt, someone must have disconnected all four spade lugs, and then put them back where they looked like they were supposed to go. But tracing the PCB pattern revealed the truth. The output leads from the reverb unit had been reversed so that the cable's shield, and with it the entire metal reverb housing, were connected to the signal input. No wonder the thing dropped took off like a rocket!

So Tom and his trusty digital oscilloscope were heroes for the day. The amplifier worked as new, and its owner got himself one fine guitar amplifier for a service fee of just under $150, including his new 'toob'. And I got the satisfaction of knowing I could still handle tubes just like in the good old days — in fact I still knew, from memory, the pin-outs for a 12AX7. And I even remembered how to get a 300-volt shock from pins 1 or 6, where the plate voltage lurks.

Yes, friends, valves are indeed alive and well. And I passed the test, so I get to work on them again. And get paid for it! ❖

ARTHUR CUSHEN: 1920-1997

The Shortwave Listening column opposite is sadly the last we shall be able to run, because columnist Arthur Cushen passed away on Saturday September 20, after battling cancer for six years. As noted in our October issue, Mr Cushen had contributed his informative notes to the magazine for over 45 years.

Although blind from an early age, Arthur Thomas Cushen became an acknowledged expert on shortwave broadcasting and listening. Based in Invercargill, New Zealand, he contributed to many publications and shortwave news programs around the world. He also conducted monitoring services for many international broadcasters.

Awarded a QE2 Coronation Medal in 1953 for his services to the blind, he was also awarded an MBE in 1970 — for both his services to the blind and for his radio journalism.

We feel sure that a great many *EA* readers will join with us in offering our sincere sympathies to Arthur's widow, Mrs Ralda Cushen.

Here is a short tribute to Arthur's achievements, contributed by his friend Peter Lankshear (also a former EA columnist):

With a shared interest in radio, and with our both attending the same Methodist Church, I knew Arthur very well. A most remarkable man in many ways, he was modest and unassuming, remaining quietly in the background of a crowd, but intently following what was going on. He never paraded his blindness, or traded on it, but turned it to his advantage, developing an incredible total recall of events, facts and figures. I could phone him for information regarding a most obscure transmission from some out of the way place, and without hesitation he would rattle off programme times and frequencies and, as a bonus, often provide some additional interesting facts. Despite his handicap, he managed to publish two internationally successful books.

Arthur's skill as a DXer and his knowledge of the radio spectrum were legendary. There was no contest when he entered a DX club competition. He knew his way around the dial better than most of us know our own homes. Although in later years he used keypad-equipped receivers, for many years his workhorse was a Racal RA17. As many readers will be aware, in this fine receiver, tuning is divided up into 1 MHz switched bands. With it, somehow, Arthur could navigate the spectrum with more facility than most sighted operators.

On several occasions, at the local radio station, I observed Arthur recording his regular DX programmes for overseas organisations. He was a recording operator's ideal. An accomplished Braille reader, the few notes he needed were on a small card, and consequently he did not need to drop his head when referring to them — a definite advantage when using a microphone. He also had an uncanny sense of timing, being able, given a brief signal half a minute before time, to record a quarter hour's programme with a five second margin.

Arthur filled a great need during the War years. Governments were often lax in communicating with each other details of prisoners of war captures, and often months went by before relatives knew officially if their son or husband was safe. In an effort to attract listeners to propaganda broadcasts, prisoners' names were often sandwiched in between news bulletins, and Arthur maintained nightly vigils copying these names for passing on to relieved families — both in New Zealand and further afield, including America. Just when he managed to sleep is a mystery, but for these services during World War II and the Korean and Vietnam campaigns, Arthur was awarded a well earned MBE.

In more recent times, he was the official observer for organisations like the BBC and Radio Canada, reporting regularly on reception conditions and the quality of their broadcasts.

He was the man for his time. We will not see his like again, both because Arthur was unique, and the fact that an era paralleled by his lifespan is disappearing.

As a small child, he saw the birth and growth of broadcasting, both medium and shortwave, but the broadcast band has now become the domain of local services and the place of international shortwave transmissions is now being taken over by satellites and the Internet.

Vale, Arthur.

SHORTWAVE LISTENING

with Arthur Cushen, MBE

Part of BBC World Service privatised

Listeners to London may not be aware that the programme delivery section of the World Service is now under the control of a private company, Merlin Communications International. Merlin are responsible for the transmission from Bush House in London to the various transmitter sites, and in the United Kingdom they have control over the transmitters at Skelton, Rampisham, Woofferton and also the powerful mediumwave station at Orfordness.

Merlin also takes possession of the BBC's Global Distribution System, although it does not get to own the overseas transmission sites. Ownership of these, which are subject to some delicate political deals with foreign governments, will stay in the hands of BBC World Service and the UK Government.

Some 200 BBC World Service transmission staff have transferred to the new company. Merlin's staff will operate the business on behalf of the BBC. They will, as before, run the operation from Bush House in London — both the office work and that of the Bush House control room, which Merlin will operate but not own. Merlin will also run and maintain all transmission sites, including those still owned by the BBC World Service and the UK Government.

So the bottom line is that the BBC has put all its international radio transmissions into the hands of a private company. The big question will be, will the BBC always be able to get its programmes to where it wants them to go?

Merlin has a contract to transmit BBC World Service programmes for 10 years, to provide high quality transmission and distribution services and project management services. The aim is to create a partnership, with open accountability for the money that the BBC will spend with Merlin — £32 million in 1997/98.

Merlin Communications is largely made up of former BBC managers and employees. Three members of the former BBC World Service Programme Delivery Service are on the board, as well. One of the Directors is Peter Gordon, who was Head of Asia/Pacific transmission services and a BBC staff member with whom I worked over many years.

New site for HCJB

Further information has become available concerning the move of the transmitting facilities of HCJB, Pifo to a new area outside Quito. The move is necessary as the Ecuadorian Government requires the area for a new International Airport to serve Quito. The move will take place over a three year period and is not expected to disrupt broadcasts significantly.

HCJB World Radio bought the present 110-acre transmitter site, 18 miles east of Quito, in 1951. It houses 11 shortwave transmitters with a combined power of more than one million watts and features 32 antenna systems supported by 48 towers.

Long before the new airport was announced HCJB was already looking for new broadcast sites closer to target audiences. The move allows the station to reorganise the ministry in the light of many new opportunities worldwide.

Tonga on shortwave

After a silence of some five years the Tonga Broadcasting Commission has reactivated its shortwave transmitter on 5030kHz. The transmitter at Nuku'alofa was hit by a cyclone in June and all facilities were off the air. Due to a lack of electricity the mediumwave station A3Z was off for four days and once that was repaired work began on the aerials for the FM service. The final work on the shortwave transitter put it back on 5030kHz with 1kW and operating 1900-1300 UTC.

A look at the history of Tonga Broadcasting Commission shows that in 1961 ZCO was using 1020kHz and a power of 1kW. On August 6 1972, it was heard with its newly allocated callsign A3Z. Transmissions in 1979 were moved from 1020 down to 1017kHz, when the 9kHz separation came into operation in all areas of the world except in the Americas.

A UNESCO project in 1985 sought to supplement this mediumwave service with three local FM stations for the major island groups. However, even with high power it turned out that the population was so thinly spread over so many islands that only a small portion could be served. The next step was to provide a 1kW shortwave transmitter to help cover the outlying islands. Another low-cost UNESCO transmitter design was used, which worked well and was widely heard on 5030kHz until February 1992 when it was damaged in a hurricane. ❖

AROUND THE WORLD

ALASKA: The KNLS schedule in English to March 29th, 1998 is 0800-0900 on 6150kHz and 1300-1400 on 7365kHz.

ALGERIA: Radio Algiers broadcasts in English at 2000UTC on 11,715 and 15160kHz.

HAWAII: KWHR is operating its second 100kW transmitter at 1300-1900 on 7510kHz; 1900-0700 on 17,555kHz; and 0700-1300 on 11,565kHz. The first transmitter is to be used for the South Pacific 24 hours a day, while the second transmitter covers broadcasts to Asia.

IRAN: VOIRI broadcasts in English 1130-1230 on 9555kHz, 11,875 and 15,260kHz; 1530-1630 on 11,790kHz and 13,650kHz; and 2130-2230 on 6155 and 6175kHz.

NEW ZEALAND: RNZI Wellington's new schedule, to March 29th, 1998 is 0458-0815 on 11,905kHz; 0816-1206 on 9700kHz; 1650-1852 on 9810kHz; 1853-2051 on 11,735kHz; and 2052-0457 on 15,115kHz. There are some minor time adjustments at the weekends.

PAKISTAN: Radio Pakistan has low speed news in English at 0230-0245 on 15,120kHz, 15,485 and 17,705kHz.

PALAU: An additional 100kW Harris transmitter has been shipped to Palau for KHBN, which will augment their shortwave service to Asia and the Pacific. The Voice of Hope now has additional Russian transmitters beamed to Central and Southern Asia, while the King of Hope shortwave transmitter in Lebanon was destroyed by fire recently. KHBN is received on 9965kHz during their service to Asia with English at 2200-2400.

SRI LANKA: SLBC heard with a request programme in English to listeners in South East Asia at 0230 on 9730kHz. The SLBC programmes are now being broadcast into Europe on a BBC Skelton transmitter on Saturday 1900-2000 on 5975kHz, but this channel is blocked in this area by Radio Korea. ❖

This summary of shortwave listening lists the frequency in kilohertz and the time in UTC (GMT), 11 hours behind Australian Eastern Daylight Time and 13 hours behind New Zealand Daylight Time. The information was compiled from listening by Arthur Cushen, of 212 Earn Street, Invercargill, New Zealand.

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Here we feature some items from past issues.

December 1947

Radio To The Moon: The moon seems destined to play a big part in our propagation experiments using radio waves. Not long ago, American radio engineers claimed to have received a radar echo from its surface. Now our own physicists have done the same thing here in Australia, with much less elaborate equipment.

It isn't just a desire to spend money in scientific stunts which encourages them to experiment in this manner. Australia has always played an important part in the propagation sphere, and has contributed valuable data to its many phases. Long before the war, Australian research into the ionosphere gave important results which later had their bearing on communication and radar developments during the war.

Radar Beacon: A small radar beacon for lighthouses, emitting signals which will be detected by radar-equipped ships, has been built by General Electric for the United States Coast Guard. It was tested at special demonstrations of merchant marine navigation aids in May, at New London, Connecticutt.

December 1972

Liquid Crystals used in Large-Screen Display: Words, numbers and drawings can now be written by laser light on a new kind of large screen black and white display demonstrated by scientists at Bell Laboratories in New Jersey. The new display uses a laser beam to write information, which can be transmitted over ordinary telephone lines, on a liquid crystal contained in a small glass slide. The liquid crystal used is a transparent cholesteric fluid that becomes frosted when momentarily exposed to concentrated doses of heat.

Laser-driven liquid crystal displays are now being considered for use at Bell Labs in an experimental 'remote blackboard' system for transmitting and receiving handwritten information over the Bell System telephone network.

New Varicap Diodes: A new type of silicon varicap diode developed in the US by Varian Associates combines the high Q and high capacitance ratio offered by the mesa geometry with the reliability and high yields characteristic of planar fabrication. Called 'Plesa' diodes, they are ideal for tuning and modulation at microwave frequencies up to 20GHz.

A contraction of planar-mesa, the trademark 'Plesa' is actually used to identify the passivation method used in making the new devices. Each chip on the wafer is passivated with a thermal oxide passivation layer immediately following etching of the mesa plateau, and before the junction diffusion is made. The mesa geometry is used because it gives superior RF performance. ❖

EA CROSSWORD

ACROSS

1 Bright flashing light. (6)
4 Join parts of a kit. (8)
10 Description of alternative to pay-TV. (4-2-3)
11 Term in automotive electronics. (5)
12 Adjust for maximum performance. (4)
13 Award named after Baird. (5)
14 Name of zone of non-reception of radio. (4)
17 Resin producing negative charge by friction. (5)
18 Alloy. (6)
20 Charge-coupled device. (1,1,1)
21 Space laboratory launched in 1973. (6)
22 Visible aspect of electrical storm. (5)
26 Unit of sound loudness. (4)
27 Outburst from the Sun. (5)
28 Part of VHF. (4)
31 Pass into disuse. (5)
32 Bass speaker. (9)
33 Substance that exhibits luminescence. (8)
34 Discharges over gaps. (6)

SOLUTION TO NOVEMBER 1997:

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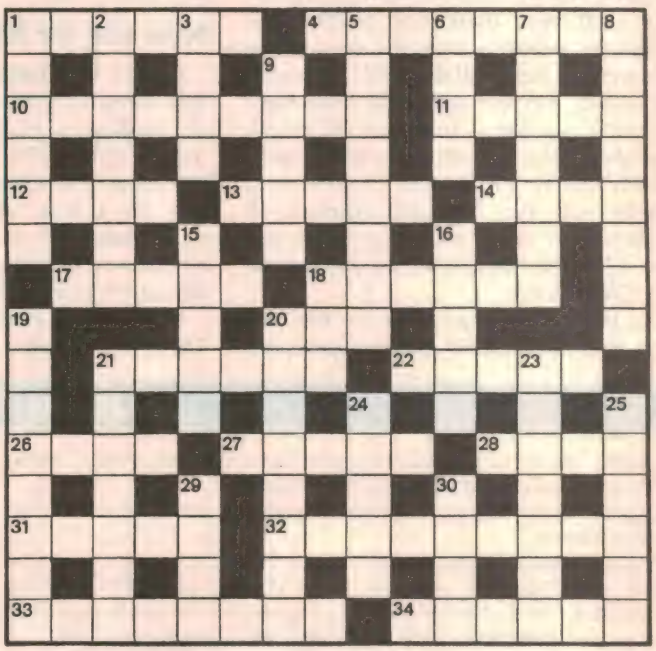
DOWN

1 Freedom from danger. (6)
2 Metal used in high temperature thermocouples. (7)
3 Unit of programming. (4)
5 Overhauled. (8)
6 Type of current causing energy loss. (4)
7 The circuit .... is a cut-out switch. (7)
8 Paths of planets. (8)
9 Manufacturer of digital cameras. (5)
15 Ore of element number four. (5)
16 Breakdown of lift. (5)
18 Printed circuit board. (1,1,1)
19 Circuit with two stable states. (4-4)
20 Moon of Jupiter. (8)
21 Constellation and zodiac sign. (7)
23 Device that detects certain odours. (7)
24 Galileo took it to Jupiter. (5)
25 Groups of notes. (6)
29 Word in Armstrong's famous moon statement. (4)
30 Serial TV show. (4) ❖



Electronics Australia's

Professional Electronics

S◆U◆P◆P◆L◆E◆M◆E◆N◆T

ADVANCED TELEVISION SYSTEMS COMMITTEE TESTS DIGITAL HDTV IN SYDNEY

LOCAL FIRM SUPPLIES SCADA SYSTEM FOR TICKETING AND CONTROL ON SYDNEY'S NEW HI-TECH LIGHT RAIL SYSTEM

SPECIAL FEATURE ON MODEMS AND DATA COMMUNICATIONS

NEW 500W SINEWAVE INVERTER

BANKSIA'S NEW 'WEBRAMP M3': A NETWORK ROUTER AND HUB, PLUS UP TO THREE 56K MODEMS IN ONE COMPACT BOX — LINKS A SMALL OFFICE'S COMPUTERS TOGETHER IN A LAN, ALSO PROVIDES VERY FAST AND EFFICIENT WEB/INTERNET ACCESS...

NEWS HIGHLIGHTS

ATSC TESTS DIGITAL HDTV IN SYDNEY

North America's Advanced Television Systems Committee (ATSC) has conducted the first over-the-air broadcasts of digital high-definition television (HDTV) in the southern hemisphere, in Sydney. The digital signals — with crystal clear HDTV pictures and CD-quality six-channel surround sound — were propagated from the TCN Channel 9 tower in Willoughby and were received at the Observatory Hotel, where government and industry leaders gathered to enjoy the demonstrations and to learn about the ATSC Digital Television Standard.

Additional broadcast demonstrations and a seminar on the ATSC DTV Standard were also held, for invited guests. Following the demonstrations, field tests to evaluate the performance of the ATSC DTV system in the Sydney area were carried out for several weeks.

The ATSC HDTV demonstrations, laboratory tests, and field tests were organized with the assistance of the Federation of Australian Commercial Television Stations (FACTS). FACTS is playing a leading role in a cooperative government and industry effort to evaluate the ATSC Digital Television (DTV) Standard and other possible approaches for the introduction of digital television services in Australia.

Observing the demonstrations, Tony Branigan, general manager of FACTS, said "Today's broadcast of digital HDTV marks an important milestone in Australia's ongoing efforts to bring the benefits of this new technology to the Australian people. We are actively evaluating ATSC digital television, as well as the European digital standard, to determine the best course for Australia to pursue, and this demonstration provides an important focal point for our deliberations."

The ATSC Digital Television Standard is based on the Digital HDTV Grand Alliance system created and tested as part of a 10-year process for developing a North American advanced television standard. The ATSC DTV Standard has been formally adopted in the United States, where an aggressive implementation process is under way. US DTV broadcasts will begin next year and more than 50% of American viewers will have access to at least three digital signals by the end of 1999.

The ATSC Standard has also been recommended for adoption in Canada and Mexico, and is actively being considered for adoption in other countries in South and Central America, Australasia and Asia.

SMART TICKETING FOR SYDNEY LIGHT RAIL

Australian office equipment company Microelectronic beat all comers, from both Australia and overseas, to supply the recently opened Sydney Light Rail System with their ticketing system and operations and control systems. Known as the Supervisory Control and Data Acquisition System (SCADA), it relies on Windows NT for software while the computer hardware is from Digital. However all development and design was done in Australia by Microelectronic.

Speaking from his Sydney office, Microelectronic MD Ted Tiltins OAM said "The ticketing system was designed by us and operates in a similar way to the now familiar bank ATM's. An LCD screen leads passengers through a series of steps to purchase their tickets on Sydney's Light Rail."

"Our experience in designing, supplying and maintaining Electronic Ticket Machines for NSW City Rail in 1988 was certainly beneficial in winning this tender."

Microelectronic not only created, supplied and installed the ticketing system but more importantly they were able to integrate six operational functions through one central control room. This means that one person can control the whole Light Rail System including the closed-circuit TV surveillance system, the radio communications to all trams, signal monitoring, the public address system, and traction power monitoring and control to ensure the correct power is being drawn by each tram.

Mr Tiltins added "Linking all these functions through a fibre optic network is unique and used for the first time in Australia."

Mr Chris Adams, who has in excess of 20 years experience in transport operations and is the Project Manager for Sydney Light Rail noted "The Sydney Light Rail was established in less than twelve months and now we have seven trams running over 3.6 kilometres of track. We hope to expand to Circular Quay and Lilyfield in the not too distant future. At the moment we have only seven stations, but the beauty of the integrated Microelectronic system is that it will allow us to easily go to 255 stations."

DISKONCHIP EMERGING AS STORAGE STANDARD

Offering up to 72MB in a single 32-pin DIL package, the M-Systems DiskOnChip appears to be emerging as a *de facto* standard for Flash data storage modules in the embedded market. Widespread industry support for the DiskOnChip is continuing to grow, according to analysts.

The DiskOnChip is offered in capacities of 2-72MB, with future models having capacities of 144MB and up, in a package smaller than a matchbox. The closest chip set solutions from other vendors provide only 8MB, making DiskOnChip the superior solution in terms of density, performance and cost.

Since its introduction, DiskOnChip has been shipping in large quantities, and has been designed into the embedded PC motherboards of most SBC manufacturers in the world. Being a flexible design, it enables upgrades to higher capacities without any need for additional integration.

Other applications include hand held devices, Point of Sales and Point of Information systems, next-generation entertainment and multimedia consoles including DVD players, and Internet access devices such as Internet TVs and digital set-top boxes.

TEK BUYS SIEMENS COMMS TEST BUSINESS

Tektronix Inc. has announced an agreement to purchase Siemens Communications Test Equipment GmbH (SCTE), a wholly-owned subsidiary of Siemens based in Berlin.

SCTE had revenues of approximately US$60 million in its last fiscal year. All of SCTE's approximately 230 employees who are based in Berlin are expected to join Tektronix. In addition, approximately 15 employees based in Stockholm and a majority of the 45-person salesforce throughout the world are expected to join.

FORD FIRST WITH OPTUS VSAT TECHNOLOGY

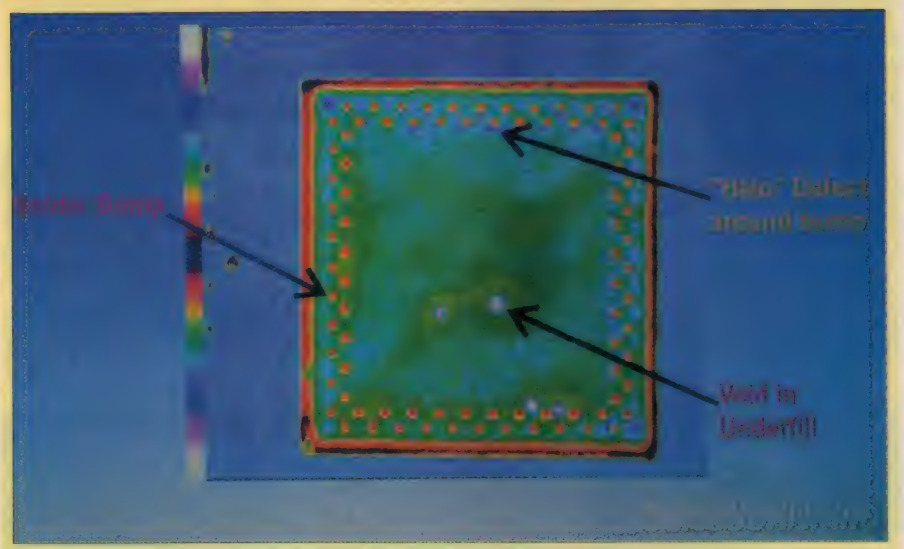
Ford Australia will become the first user of Optus Communications' VSAT (Very Small Aperture Terminal) satellite technology — called DataReach — in a five year, multi-million dollar agreement. Ford plans to use the DataReach product to network its 300 dealerships across Australia, enabling it to provide distance education, training and marketing communications via interactive television.

The new interactive learning network, known as Fordstar, will remove the barrier of distance and allow dealer staff access to current information and technical training. Ford believes this will result in the provision of even better customer service.

Pilot testing will begin in January 1998, with the full rollout to dealerships due for completion by June. The five year agreement with Ford Australia makes provision for an extension of the contract for an additional five years.

The cost of small earth station technology has fallen significantly in the past five years. In 1992, the total cost of a terminal was approximately $25,000. Today, Optus DataReach makes it possible to deliver two-way integrated data and video conferencing to a terminal, including satellite dish and decoder, for less than a third of the 1992 cost.

ULTRASONICS FINDS FLIP CHIP DEFECT



A flip chip defect in which underfill material flows around, but does not come in contact with solder bumps has been demonstrated in the applications laboratory of Sonoscan Inc., which specialises in acoustic analysis of chip defects.

"This defect consists of a tubular delamination partly or completely surrounding the solder bump", explained Dr Lawrence W. Kessler, president of Sonoscan. "Since the underfill material does not completely surround the bump as it is designed to do, the delamination leaves a space into which the bump can migrate."

The defect, which has been noted in multiple lots of flip chips imaged at Sonoscan, typically affects several solder or polymer bumps on the same device. Although the precise cause of the defect is undetermined as yet, it may result from incomplete wetting of the solder bumps as a result of flux residue.

Since the tubular delamination is quite thin, it is extremely difficult to detect by either X-ray or destructive physical analysis. And since migration of bump material occurs slowly, this type of defect would be undiagnosed during initial electrical testing. In the field, however, it would eventually cause a failure.

A family of high-resolution ultrasonic transducers with the good penetration needed to image flip chips is currently under development at Sonoscan. The 180MHz transducer, the first transducer expressly designed for flip chips, was released earlier this year.

COMPUTER PRODUCTS ACQUIRES ZYTEC CORP

In one of the biggest acquisitions in the power supply industry, Computer Products Inc recently signed an agreement to acquire Zytec Corp, creating one of the world's leading providers of power supplies and power systems for the communications market. The agreement provides for a share-for-share exchange and is valued in excess of US$500 million on a fully diluted basis.

Based in Minneapolis, Zytec is a leading designer and manufacturer of custom power conversion equipment for OEMs in the communications, networking, computer and other electronic equipment manufacturers. It currently employs 2800 people in facilities located in the USA, Austria and Hungary.

Computer Products Inc, headquartered in Boca Raton, Florida is a manufacturer

of standard and custom-designed power supplies and subsystems for the communications industry and other real-time applications. The company has operations in the USA, Hong Kong, China, Republic of Ireland, Germany, Netherlands and the Czech Republic.

Amtex Electronics has been the Australian distributor for Computer Products for over 11 years and prior to that its predecessor, Boschert Inc.

INTEL APPOINTS SYNNEX AUSTRALIA AS DISTRIB

Synnex Australia has signed on as a Master Distributor for Intel's CPU and motherboard products. With offices in all major markets around the world, Synnex is one of the largest global IT distribution companies.

Synnex currently has offices in Melbourne, Sydney and Brisbane, with offices due to open in Perth and Adelaide in the near future. With a complementary range of products from Intel, Mitac, Fujitsu, Adaptec, Hercules, Motorola, Yamaha and many other leading brand vendors, Synnex is able to offer a turnkey solution for most dealers and VARS.

Synnex Australia was formed in March this year when leading PC supplier Mitac Australasia merged with the global giant Synnex International in a strategic move to globalise their operations. Mitac Australasia has been an active player in the Australian market for over six years.

The CeBIT trade fair in Hannover, Germany is generally agreed to be the world's largest and most comprehensive for IT and telecomms technology. Next year's fair will take place from March 19 to 25.

SAMSUNG PRODUCING 533MHZ ALPHA CHIP

For over a year, Korean semiconductor firm Samsung Electronics has been involved in developing CPU technology in an effort to expand its non-memory product line. The company has now announced the completion of its Alpha chip development program, and has begun full-scale mass production of a 533MHz version of the CPU. A 600MHz version was espected to be in production by the end of the year. Samsung expects annual sales of US$1 billion by 2002.

The prototype was completed in October '96, and hundreds of samples were sent worldwide to be tested. The Alpha chip will operate workstations and servers with Windows NT/UNIX systems. In order to capture the visual computing market, it embodies functions such as 3D graphics, computer-aided design, moving pictures, and virtual reality.

Early next year Samsung Electronics plans to broaden its Alpha chip product line by producing CPUs for the PC which consume less energy, but deliver high performance for lower cost.

NEW VALVE TECHNOLOGY MAGAZINE

US magazine publisher Audio Amateur Corporation, based in Peterborough, NH has launched a new business-to-business publication titled *V&T News (Valve & Tube)*. Edited by Lynn Olson, the periodical is being published bimonthly beginning with the first issue in September. The publication will be distributed free to qualified industry personnel in the United States and Canada. It will cost US$50 per year for overseas subscriptions.

Coming out of a long tradition of high-quality audio information, AAC says that *V&T News* has been developed in response to the need for an industry publication to serve professionals working with vacuum tube audio. Already publishing *Voice Coil*, the industry publication for the loudspeaker industry, the company believes it is uniquely qualified to present the news, technology, reviews and updates needed by the expanding vacuum tube audio industry.

On the forefront of the resurgence of vacuum tube audio, publisher Ed Dell started *Glass Audio* magazine in 1988. Focusing on do-it-yourself vacuum tube audio, *Glass Audio* has enjoyed steady growth in the past nine years and is read by audio consumers and professionals alike.

KOPIN & MOTOROLA SIGN PDP ALLIANCE

Kopin Corporation and Motorola recently announced a multi-year, multi-million dollar business alliance agreement under which the companies will develop, manufacture and market low-cost, low power portable communications flat panel display products based on Kopin's CyberDisplay active matrix LCD technology.

Kopin's CyberDisplay is claimed to be the world's smallest high-performance, high resolution, full function information display. Based on Kopin's patented Smart Slide technology, the CyberDisplay is a 0.24" diagonal transmissive active matrix liquid crystal display (AMLCD) imaging device which displays information at 320 x 240 pixel resolution. It enables portable communication devices and personal information products, including cellular phones and pagers, to display text, e-mall, graphics and video from Internet, intranet and other data or video sources.

MARCONI SCHOOL STUDENT RE-UNION

More than 100 former students attended the first ever re-union of the Marconi School of Wireless, held in Sydney on September 20 1997.

Amidst an emotional welcome to the guest of honour, long-time Marconi School Manager Cec Bardwell was presented by David Hawksworth, the event MC, with a genuine ship's Morse key as a tribute to his great service to the communications industry and as an indication of the affection in which he is held by former students.

Founded by AWA in 1913, the Marconi School of Wireless trained many thousands of radio operators for positions on land, at sea and in the air, both in peacetime and for service in both World Wars. In addition hundreds of technicians and engineers were trained for broadcasting and industry before the school finally closed its doors in 1981, on Cec Bardwell's retirement.

The re-union was also honoured by the attendance of two former students — Alf Chandler, who started his training in 1924, and Glen Mumford, who studied at the school in 1928. Glen went on to become the Chief Radio Officer for Qantas during World War II.

To generate publicity for the re-union an Internet home page was developed by Col Christiansen, and will continue indefinitely to promote the history of one of Australia's most successful private training organisations. The URL is **www.suburbia.com.aul/~colinc/marconi.html**. (Courtesy Dave Jeanes)

PROCESS COATS HDD'S WITH DIAMOND ARMOUR

Researchers at the Ernest Orlando Lawrence Berkeley National Laboratory in California have developed a way to increase the storage capacity of computer hard disk drives. Simone Anders of the Accelerator and Fusion Research Division at Berkeley Lab and her colleagues from IBM and UC Berkeley have found a new way to shield disks and sliders, or reader heads, with ultra-thin 'overcoats' of diamond-like carbon which can survive repeated crash landings at 3600rpm.

IBM has already brought to market disks that store 2.64GB of data per square inch; densities almost twice that have been demonstrated, and researchers are aiming for 10GB per square inch and more. To read a disk where magnetic domains are packed only 25nm apart, disk surface and slider will have to move so close to each other that it's almost a matter of semantics whether they will actually be touching.

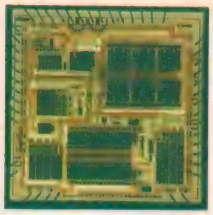
The technique involves use of a fully ionised carbon plasma to deposit carbon molecules onto the disk and slider surfaces, where they reassemble in a diamond lattice. A system of magnetic fields rather like that in a mass spectrometer is used to filter out macroparticles and produce an extremely flat and hard film. ❖

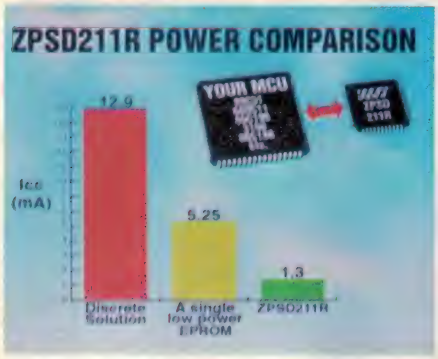
NEWS BRIEFS

- ***BBS Electronics Australia*** has been appointed as a distributor for Vantis, a new programmable logic company from AMD.
- Australia's third international ***Solar and Advanced Technology Boat Race*** will be held in Canberra on Saturday May 9, 1998 during the sixth Australian Science Festival, which now hosts the race as a major festival event each year.
- ***Quest Electronics*** has been appointed as the sole Australian distributor for the UK company Video Tech Design. This company designs and makes a range of video post-production equipment.
- Sydney-based custom AV installation specialist Leisure Imports has changed its name to ***LeisureTech Electronics***, as the company's activities are now much wider than importing. The company has just celebated its 20th anniversary. ❖

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY...





Low power MCU support IC

WSI has introduced an ultra low power, 5V programmable MCU support IC, the ZPSD211R. The device is claimed to consume 80% less power than a stand-alone 5V EPROM and integrates 32KB of EPROM, a programmable address decoder, a simple PLD, extra I/O ports, security features, and a programmable interface to any 8-bit microcontroller from Intel, Motorola, Philips and others.

In an 80C31-based system with an MCU clock speed of 6MHz, the IC consumes 1.32mA, including loading, and its standby current consumption is 20uA. It also has a security bit that can be set to make the device configuration invisible, thereby making it difficult to reverse engineer or duplicate the program code.

For further information contact WSI, 47280 Kato Road, Fremont, CA 94538; phone +(510) 656 5400.

Op-amp has rail-rail output

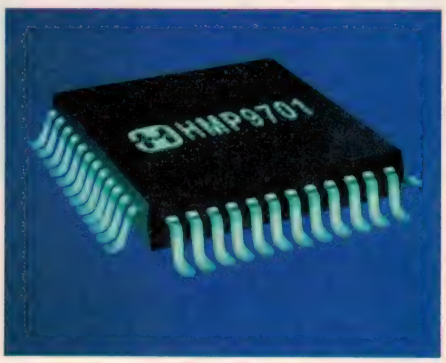
The AD8051/AD8052/AD8054 family of high-speed amplifiers has an output signal that can swing to within 25mV of either supply rail. The AD8051 is a single amplifier and the AD8052 and AD8054 are dual and quad versions respectively.

The devices operate with +3V to +12V single supplies and can also be used with +/-5V dual supplies. The bandwidth is 100MHz, and the slew rate is 140V/us. When driving a 50pF load, the amplifiers settle to within 0.1% in 30ns. Each amplifier consumes 4.5mA. Applications include CCD imaging, CD or DVD, video line drivers, LCD displays or buffering an ADC.

For further information circle 277 on the reader service card or contact Analog Devices, PO Box 98, West Rosebud 3940.

AC'97 audio codec

The new Harris Semiconductor HMP9701 audio codec device is claimed to fully meet the Audio Codec '97 (AC'97) specification developed by Intel, Creative Labs and others. AC'97 digital audio controllers support sample rate conversions to and from 48kS/s, Sound Blaster compatibility, FM and/or wavetable synthesis, and AC-3 decoding. An AC'97 controller can exist as a stand-alone IC or as an embedded function within a multifunction PC card.



The new IC provides AC'97 analog and mixed-signal functions and supports the AC-link for all AC'97 controllers. As well as the audio input and output, the HMP9701 mixer manages playback and recording of all digital and analog audio input sources present in a PC. It is housed in a small 48-lead thin quad flatpack and consumes less than 500mW.

For further information circle 273 on the reader service card or contact BBS Electronics Australia, Unit 24, 5-7 Anella Avenue, Castle Hill 2154.

20-bit audio codec has integrated DSP

AKM Semiconductor has released the AK7712A, an IC which integrates a 20-bit stereo A/D, four 20-bit output D/A channels and a proprietary 24-bit fixed-point DSP. The chip has a dynamic range of 97dB for both the A/D and D/A channels and has a proprietary delta-sigma architecture.

The DSP engine allows 383 instruction cycles, with up to six operations per cycle, and operates with a 48kHz audio sample rate. The chip suits a range of applications, as the A/D, D/A and DSP sections are accessible independently. For example, by adding an external low cost stereo D/A, a full six-channel output system can be implemented.

For further information contact AKM Semiconductor Inc, 2001 Gateway Place, Suite 650W, San Jose, CA 95110; phone + (408) 436 8580 (Internet **http://www.akm.com**).

PAL/NTSC video encoder-decoder for PCs

The new Harris Semiconductor PAL/NTSC video encoder-decoder chipset consists of the HMP8112 decoder and HMP8156 encoder. The decoder IC contains a comb filter implementation for better luminance/colour (Y/C) separation without loss of vertical detail; a sample rate converter that lets the decoder use any available clock instead of a specific clock frequency; and digital phase locked loops (PLLs) for steadier images in PC-based home video editing equipment. It accepts both CVBS (composite video blanking and synchronisation) and S-Video (separate luminance and chrominance) analog video formats. Compatible sources include cameras, VCRs and professional video equipment.

The encoder performs the opposite function to the decoder and accepts inputs in three formats: YcbCr, 16/24-bit RGB, and Bt.656. YcbCr is the output format used by MPEG decoders in set-top boxes, Bt.656 is a high-end professional digital videotape standard and RGB is the common format for PC multimedia cards.

For further information circle 275 on the reader service card or contact BBS Electronics Australia, Unit 24, 5-7 Anella Avenue, Castle Hill 2154.

10-bit 100MS/s ADC has TTL interface

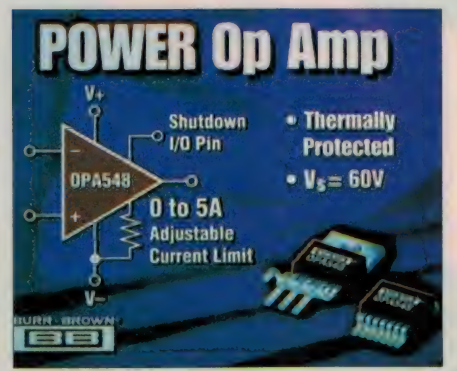
Analog Devices has announced the AD9071, a new 10-bit monolithic analog-to-digital converter (ADC) with TTL compatible outputs. It has a 100MS/s sampling rate and 600mW power dissipation, and is optimised for use in point-to-point and satellite communications, as well as digital oscilloscopes and spectrum analysers.

The device has a 230MHz bandwidth and features include an on-chip reference and track and hold; separate output power supply pins to support interfacing with 3V or 5V logic; out-of-range output indication; an input amplifier that supports differential or single-ended interfaces; and single +5V supply operation.

For further information circle 274 on the reader service card or contact Analog Devices, PO Box 98, West Rosebud 3940.

Power op-amp has 0 - 5A current limit

Burr-Brown's new OPA548 is a low cost, high-voltage, high-current operational amplifier capable of driving a wide variety of loads. It operates from either single or dual supplies up to +60V (+/-30V), is internally protected against current overload and over-temperature conditions, and features an enable/status pin which disables the output and also indicates if the amplifier is in thermal shutdown.



The device has a user-selected current limit of zero to 5A, and instead of a resistor in series with the output current path, the IC senses the output current indirectly. This allows the current limit to be programmed with a 0 to 330uA control signal. It has a common-mode rejection of 95dB and an open loop gain of 98dB.

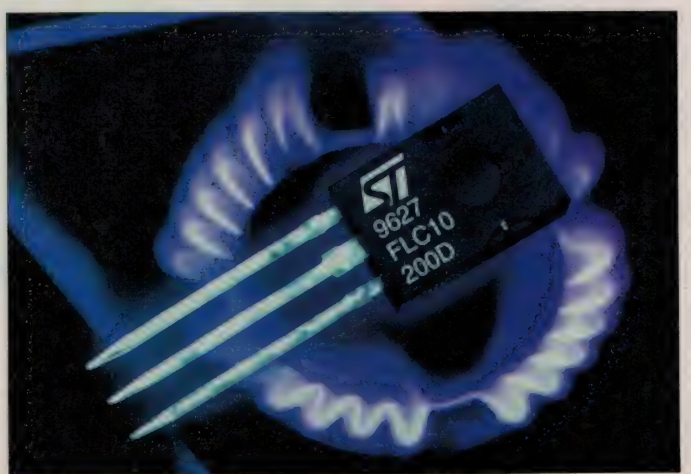
For further information circle 271 on the reader service card or contact Kenelec, 2 Apollo Court, Blackburn 3130.

High power fire lighter IC

The FLC10-200D from SGS-Thomson Microelectronics is a high power version of the company's FLC01-200D fire lighter circuit that is widely used in gas cookers, gas boilers and similar appliances that employ capacitive discharge ignition (CDI).

The IC is a two-terminal device that combines a 240A (non-repetitive peak surge current) thyristor that manages the capacitive discharge switching function, a zener diode that sets the threshold voltage, a rectifier for reverse conduction and a 1k ohm current limiting resistor. It operates from an AC mains input and energy is stored in an external LC circuit via a series resistor and rectifier.

For further information circle 272 on the reader service card or contact SGS-Thomson Microelectronics, Suite 3, Level 7, 43 Bridge Street Hurstville 2220. ❖



A very logical prize!

HEWLETT PACKARD

Hurry!

Win one of 7 HP LogicDarts

Electronics Australia and Hewlett-Packard are giving away 7 HP LogicDarts valued at $1,130 each. _Total Prize Value $7,910._

The HP LogicDart is an advanced logic probe that not only performs basic logic monitoring and analysis, but also tests continuity and measures frequency and dc voltage, eliminating the hassle of switching tools and keeping you focused on solving problems. It's the perfect tool for first-level troubleshooting.

Features include:
* Single probe to make required measurements.
* Precise probe tip which allows you to probe fine-pitch surface mount circuitry.

How to enter:
Simply subscribe or renew your subscription to *Electronics Australia* for the discount price of only $49, (saving you $22.40 on the normal cover price) and you will receive automatic entry into the draw to win one of these seven Hewlett-Packard LogicDarts.

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Conditions of Entry. **1. The competition is open to Australian residents authorising a new or renewed subscription to *Electronics Australia*. Employees of the Hannan Group, Hewlett-Packard, their subsidiaries and families are not eliible to enter. 2. Prizes are not transferable or exchangeable and may not be converted to cash. 3. The judge's decision is final and no correspondence will be entered into. 4. The competition commences on October 13, 1997, and closes last mail on January 20, 1998. 5. The draw is at the promoter's premises on February 3, 1998 at 11am and the winners will be announced in the May 1998 issue of Electronics Australia, on sale April 23, 1998, and notified by mail. 6. The prize is one of seven Hewlett-Packard LogicDarts, valued at $1,130 each. Total prize value is $7,910. 7. Subscriptions are not refundable. 8. The promoter is the Federal Publishing Company, 180 Bourke Rd, Alexandria, NSW 2015. 9. All entries become the property of Federal Publishing, and may be used for future marketing purposes. NSW Permit No. TC97/7023; ACT Permit No. TP97/0658; NT Permit No. NT/97/pending; SA Permit No. T6831. VIC Permit No. pending.**

Offer Ends January 20, 1998

Product review:

BAINTECH 500W SINEWAVE INVERTER

Featuring a genuine sinewave output, 1500 watts of surge capacity and very rugged construction, the Baintech 500W/12 from Queensland-based Bainbridge Technologies is quite an impressive beast. The design has reportedly undergone an extensive testing period in the extreme heat and humidity of North Queensland during mid summer, and should therefore be able handle just about anything that the rest of Australia can throw at it...

by ROB EVANS

It probably goes without saying that the ideal way to power a mains appliance is from the 240V/50Hz AC mains supply itself, or from a source that closely complies to that rating and waveshape. When this alternative source is a battery powered DC-AC inverter however, the output is often in a 'modified squarewave' format which offers a less than ideal rise time and overall waveshape for more 'sensitive' mains appliances, in particular.

Of course the reason behind this situation is primarily one of efficiency and cost, since a high voltage squarewave can be generated using relatively low-cost switching devices which waste little power through heat loss. The digital nature of this output can only ever approximate the sinusoidal mains waveform by reducing the width of each positive- and negative-going pulse (with a rest period in between), which creates an output with an equivalent *RMS* voltage rating to that of the mains.

While this isn't a problem for resistive loads such as incandescent lamps and heaters, which just react to the heating capability (RMS level) of the source, many appliances such as audio/video equipment, radio gear and test equipment can be badly effected by the rapid rise-time and sharp edges of a squarewave-based mains signal. In these situations, an inverter with a true sine wave output is clearly the best way to go...

Sine wave inverters have in fact been available for some time, but due to the difficulties involved in generating what is essentially a high power, high voltage *linear* output signal — as opposed to a switched squarewave — many of the designs have been low-powered, rather cumbersome and electrically inefficient. In fact it's not unlike the comparison between conventional class-B audio amplifiers and the more exotic class-A designs, which suffer from similar drawbacks.

With this in mind, we were particularly interested in taking a better look at the Baintech 500W/12, which is surprisingly light and compact for a 500W *sinewave* inverter, and has an impressive efficiency rating — quoted at 85%. The 500W/12 measures 346 x 218 x 90mm and weighs in at just 3kg, so we would have to assume that in this case the manufacturers have achieved some-

Baintech 500W/12 sinewave inverter

Good points: Excellent performance, easy to install and use, ideally suited to Australian conditions.

Bad points: Fairly pricey. User manual could also be a little clearer on some points.

RRP: $1214, including one year warranty.

Available: Bainbridge Technologies Pty Ltd, 77 Shore Street, Cleveland Qld 4163; phone (07) 3821 333, or fax (07) 3821 3977.

what of a breakthrough in the design of sinewave inverter output stages.

As you can see from the photograph of our sample unit, the 500W/12 is housed in a low-profile industrial-style case that's designed for wall mounting, with four cable entry flanges arranged along the lower face. The case itself is made from 3mm aluminium plate with a white powdercoat finish, and its very rigid construction implies that the 500W/12 is designed to handle extreme physical as well as environmental conditions.

What is effectively the inverter's front panel holds a number of indicator LEDs, along with a large area of ventilation holes. Included are LED bargraphs for input voltage and output power, plus indicator LEDs for battery level (low or high), over temperature and standby mode. Also included is a ON/OFF toggle switch, as you would expect.

Other than that, the Baintech 500W/12 has a range of specifications that appear to support its heavy-duty theme. These include a 1500W surge power capability (a prerequisite for starting typical electric motors), a rated output power (500W) that is sustained up to operating temperatures of *60°C*, plus a relative humidity rating of 90%. It also has a quoted standby current rating of less than 200mA, which is a fairly impressive figure when you consider the unit's power capability.

Trying it out

The first task involved in bench testing the 500W/12 was to connect the 12V DC input and 240V AC output cabling, which hook-up to a pair of internal bolts and a PC-mount terminal strip, respectively. These are accessed via a small removable cover at the recessed end of the case, which also exposes the unit's bank of automotive-style (blade) fuses and a reverse polarity indicator LED.

With power then applied, the 500W/12 behaved pretty much as you would expect from this type of sophisticated inverter. We performed a number of basic tests and found that the unit generally met or exceeded the published specifications, with the major limitation in the checking process being the capabilities of our 12V DC source. While this was a reasonably beefy 12V/15A power supply, it fell well short of the current capacity offered by a large 12V battery — the inverter's usual power source.

Of note amongst the performance checks, we found that the 500W/12's standby current measured just 134mA, the output frequency was spot on 50Hz, and the output regulation (at moderate power levels) was around 7% with a typical output voltage level of 243V AC.

The efficiency figures were rather less straightforward however, since while the unit's quoted figure is 85%, this only seems to apply at higher power levels. Due to the limitations of our test setup, we could only reliably check the efficiency figures at output power levels of 50W, 100W and 150W, which produced figures of 59%, 68% and 75% respectively. As you can see, the figures increase in a quite predictable fashion, which seems to imply that the specified efficiency figure would be met in the inverter's upper power range.

In practical terms, we found that the 500W/12's operating characteristics are well thought out, and the unit performed its job without fuss. It drops into standby mode when there hasn't been an output load for more than about 10 seconds, cleanly shuts down in the event of a battery fault (say, a low terminal voltage), and activates its internal cooling fan as the need arises.

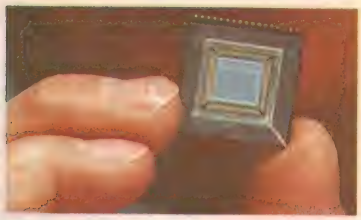
There's very little noise emitted by the circuitry or cooling fan by the way, even at higher power levels.

Checking the inverter's output waveform with an oscilloscope showed that the synthesised mains signal remained clean and stable while driving our test loads, and the actual waveshape was quite close to a pure sinewave. When compared to an ideal sinewave though, you could see that the inverter's waveform was slightly flattened on the peaks, and the rising and falling slopes appeared quite linear — much as you would find in a triangle wave.

This waveform was quite compatible with all of the mains appliances we tried on the 500W/12W, which included a number of fairly sensitive test instruments. Thanks to the lack of fast rise-times and sharp transition edges in the 240V AC output waveform (in contrast to that from conventional modified-squarewave inverter), our range of test loads performed exactly as if they were powered from a conventional mains outlet.

The Baintech 500W/12 is offered with a one year warranty and includes a small, but fairly concise user's guide and installation guide. While it would suit a very wide range of 240V AC loads — thanks to its 'clean' output — it would be ideal as a 240V AC backup system in a permanent installation, where critical and perhaps sensitive appliances are involved. ❖

Silicon Valley NEWSLETTER



IBM first with copper wired chips

After two decades of intense industry-wide research, IBM has unveiled the first advanced semiconductor that uses copper instead of industry standard aluminium, in the tiny interconnect wires that link different parts of a chip. The 0.2-micron prototype chip, which uses IBM's so-called CMOS-7S process, runs on a supply of just 1.8 volts.

Copper has long been known to be a far superior conductor of electrical signals than aluminium, but until now the material has stubbornly resisted practical application in the semiconductor manufacturing process. It has proven resistant to etch processes and has shown a tendency to contaminate the chip's surface, making it unsuitable for subsequent processing steps.

IBM's process includes a special insulator that sits between the copper and the silicon base. In addition, IBM designed a new way to flatten the copper that permits the layering of many wires inside chips.

Industry analysts say IBM has beaten competitors to the market with copper by about a year. In three to five years, copper is expected to be the interconnect metal of choice in most parts of the semiconductor manufacturing process. Besides carrying signals about 40% faster than aluminium and generating considerably less heat, the metal also represents a 30% saving in overall process cost over aluminium, due to a simpler process which allows for less expensive equipment.

IBM said it has no immediate plans to licence its technology to other chip makers. It will use the CMOS-7S process in various components used in its own computers and in chips sold on the open market.

For Intel, the IBM move will mean it will be forced to step up its own efforts to develop a copper interconnect capability. Intel had planned to come out with copper chips after 2000. Now Intel officials said they expect to come out with copper chips in 1999.

Only a couple of months ago, the Sematech consortium announced it had developed a copper process — but that commercial implementation was not expected for another three years. IBM's copper chips will start hitting the market in early 1998.

Two bits/transistor in new Intel Flash chips

Intel has announced a revolutionary new chip design that effectively doubles the amount of storage capacity of flash memory chips, which are used widely in products ranging from computers to cellular telephones.

Intel said its new 64-megabit 'StrataFlash' flash memory chip uses a technique that stores two bits of information in the same transistor. Until now, transistors have traditionally stored just one bit of data at a time. The breakthrough enables Intel to double the storage capacity of flash chips without having to invest in new production technology or equipment.

"Two bits in the space of one starts a new direction in memory technology", said Gordon Moore, co-founder and honorary chairman of Intel. "This will lead to lower cost and new applications."

It will also accelerate Moore's Law, which dictates that chipmakers will double the number of transistors every 18-24 months. Moore said the new Intel flash technology could shorten that time cycle, especially if the technique can be transferred to other types of circuits such as DRAM and microprocessor chips.

The impact of the Intel technology will be seen in the marketplace, where digital cameras will be able to take better pictures without much of an increase in memory component cost. Video games will be able to display eye-popping graphics and computers will be able to handle more tasks simultaneously.

"This is going to have a lot of impact", said Walt Lahti, analyst at market researcher In-Stat in Scottsdale, Ariz. "This basically accelerates the pattern in the computer business where you get more for less."

Industry analysts agreed that the StrataFlash chips may trigger rapid growth in the market for flash components. The flash market could grow to US$9 billion annually over the next four years, according to analysts.

Valley is top US exporter

Several times during the last 20 years, high-tech experts have predicted the decline of Silicon Valley as the centre of high-tech industry in the USA. Each time, the Valley has answered its critics with a new wave of high-tech innovations, start-ups, and domination of new mass markets.

IBM's new CMOS 7S process technology allows the company to use copper instead of aluminium for the metal interconnections on a high-density IC. The process allows six layers of metallisation, and geometry down to 0.2um — among the smallest in the industry. It's expected to yield significant performance gains. At right is a scanning electron micrograph of the metal layers.

The results are again speaking for themselves. Last year, Silicon Valley's Santa Clara County became America's largest metropolitan exporter, with US$29.3 billion worth of goods transported to customers outside the United States. That exceeded the export totals for the New York ($28 billion) and Detroit ($27.5 billion) areas. Santa Clara County alone now accounts for 5% of all US exports. Only three years ago, Santa Clara ranked fifth with US$15 billion in exports while New York ranked first with $28.2 billion.

Those numbers, impressive as they already are, tell only part of the valley's success story. With a considerable portion of Silicon Valley extended into the neighboring San Mateo, Santa Cruz, and Alameda counties, the combined exports of the greater Silicon Valley area are closer to US$45 billion, or nearly 10% of US exports.

Silicon Valley's lead is expected to grow much larger this year. The American Electronics Association has reported that US high-tech exports grew no less than 11% in the first six months of this year, to more than US$85 billion.

US continues to resist smartcards...

Smart cards seem to be joining the ranks of gun control, topless beaches and public transportation — ideas the American public has stubbornly resisted warming to, despite their acceptance in virtually every other part of the world.

A new study conducted by the Smart Card Forum, in cooperation with the US convenience store industry showed that this industry is either resisting adopting the technology or waiting for signs from other areas of the economy that the US public is ready to embrace smart cards. For now, however, most US retailers believe consumer demand is insufficient to justify investing in the technology.

The study comes on the eve of a project in New York City for the plastic cards that can be used to pay for a convenience store snack as well as a seven-course feast at a posh restaurant, or to buy a dining room suite.

The survey across 12,640 stores found that while convenience outlets are a logical place for smart cards, operators are reluctant to adopt them.

The cost of smart card readers, at a few hundred dollars, is relatively small compared to most pieces of business equipment. But the survey showed that US convenience store owners aren't convinced that even a minimal investment in smart card technology will pay off.

The problem is that to date there has been little or no consumer demand for smart cards, in part due to the same general distrust of technology that has severely limited the amount of commerce over the Internet.

"What we have ... is the typical chicken and egg scenario", said Debra Chanil, research director for *Convenience Store News*.

The largest US smart card experiment to day has been in Atlanta during the 1996 Summer Olympics. But even there merchants said they were unhappy with the technology, which often didn't operate smoothly. Besides the new test in New York, in which some 500 merchants are participating, tests are also in progress at a few military bases and college campuses.

WorldCom offers $30 billion for MCI

The telecommunication, computer, Internet and other high-tech industries have been scrambling to determine the impact of the unexpected US$30 billion takeover bid which WorldCom has announced for the MCI long-distance telephone conglomerate. Only the previous month Worldcom said it had agreed to take over part of Compuserve in a three-way deal with America Online.

Analysts quickly concluded that MCI shareholders will be hard pressed not to accept the WorldCom bid, rather than the US$23 billion offer MCI had already accepted from British Telecom. But there's a much more difficult question regarding the impact of the MCI deal on the future of the Internet, as WorldCom will gain a majority stake in the US side of the global computer network.

Some even believe the move is the cornerstone of a WorldCom plan in which the company envisions itself as the dominant global provider of long distance telephone services, using low-cost Internet connections to compete with the AT&Ts of the world.

One of the problems analysts have in evaluating WorldCom intentions is that the company has come almost out of nowhere to rise to its current position among the telecommunications giants of the world. Rather than following a traditional business growth model, WorldCom has literally bought itself to the top through acquisitions and mergers, many exceeding a billion dollars.

Recently the company agreed to buy UUNET technologies, one of the largest Internet backbone service providers. It also paid more than a billion dollars to take over the Internet backbone systems for Compuserve and America Online.

Now WorldCom may also obtain MCI's Internet business, which has been expanding rapidly and claims to have more Internet service capacity than any other entity on the planet. Even Microsoft will not be immune from WorldCom's reach as Microsoft is one of the 50,000 ISPs that use UUNET as its backbone.

WorldCom will easily become the largest ISP in the United States. Between them MCI and WorldCom control 51% of all Internet connections in the United States. Only Sprint, with 23.6% is left as a sizable competitor.

House Committee vetoes cypher interception bill

US software industry executives reacted with relief to a 35-16 vote by the House Commerce Committee against a proposal to add tough new restrictions on the use of data encryption and giving law authorities broad access to intercept and decipher coded information. The bill, supported by FBI director Louis Freeh, would have required users of data encryption products to provide the government access to decoding keys.

Instead of passing the encryption restrictions legislation, the same committee, by a vote of 44-6, approved a competing measure that prohibits any government control over data encryption technology or its use by citizens and businesses. The bill would also loosen export controls on the sale of such software to customers outside the United States.

Although industry leaders said they were pleased with the defeat of one bill and the approval of the measure they supported, they cautioned that the battle over encryption is far from over. For one, the US Congress was unable to take up a vote on the SAFE bill before the end of the current legislative session. That means the process will have to start virtually from scratch when Congress re-convenes.

H-P plans new PC factory in Holland

Tulip bulbs, light bulbs — Why not PCs? Hewlett-Packard has announced plans to build a major new personal computer (PC) manufacturing plant in the Netherlands.

The plant, which will begin production by February 1998, will cost some US$40 million to construct and will employ about 600 people when it opens. The facility is also slated to add production of business workstations and servers by the year 2000.

H-P said the selected site would be announced in October. ❖

NEW PRODUCTS

Multi-function audio monitor

The new MSD200 master stereo display from DK-Audio incorporates three traditional metering functions in a single package: a phasemeter, an audio vector oscilloscope and a level meter. As a level meter, the display provides seven international scales with individually selectable reference levels and LED overload indicators. It has an electroluminescent display that gives a high contrast ratio and a viewing angle of 160°, claimed to be the most readable audio meter in the industry.

A new feature is its ability to show the audio signal in MS-mode — in which the level meter display is configured with four level bars to indicate not only left and right channels, but also L+R and L-R. The unit can operate in both analog and digital (AES/EBU and SPDIF) input modes that are soft-key selectable. All connections are made via a rear-mounted 25-pin D connector.

For further information circle 241 on the reader service coupon or contact Amber Technology, Unit B, 5 Skyline Place, Frenchs Forest 2086.

MPEG/DVB test generators, analysers

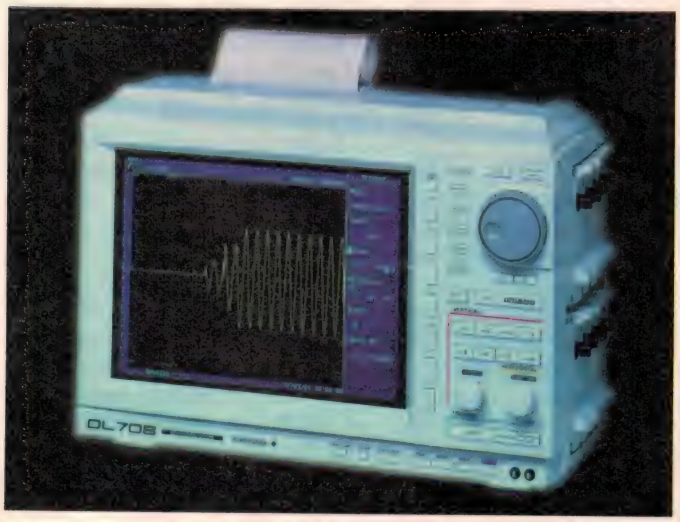
Tektronix has announced a new family of real and deferred-time analyser and generator products for use with compressed digital video systems. The MTS200 series of MPEG test systems offer MPEG and DVB analysis capabilities, and perform functions ranging from real-time analysis to custom creation and in-depth analysis of MPEG transport streams.

The series consists of the MTS215 real and deferred time analyser and generator, the MTS210 deferred time analyser and generator, the MTS210 deferred time generator, the MTS210 deferred time analyser and the MTS205 real time analyser.

The products are typically used by those involved with development, design, manufacturing or testing of MPEG coders/decoders, ICs, or other components. Functions include product design and debug, product evaluation, low-volume quality analysis, and installation and acceptance testing of MPEG broadcasting and distribution systems.

For further information circle 243 on the reader service coupon or contact Tektronix, 80 Waterloo Road, North Ryde 2113.

8-channel scope has TFT display



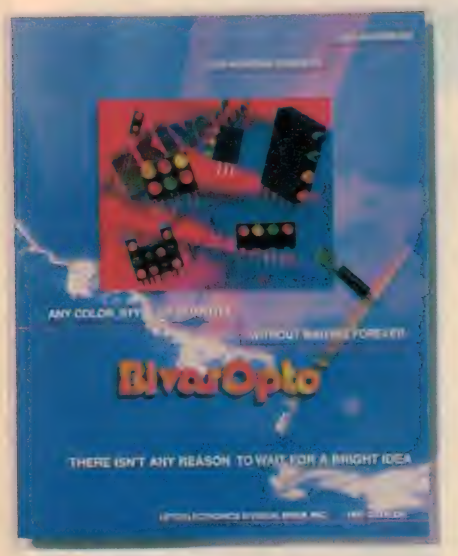
Yokogawa has added the DL708 digital scope to its DL1500 series of digital oscilloscopes. It is designed for measuring multi-channel isolated signals in a wide variety of applications, and has modular plug-in inputs for flexibility. The modules include high-speed and isolated high-speed versions, temperature and logic modules.

The instrument has a sampling speed up to 10MS/s, up to 16-bit resolution and a 16M word memory. It provides data acquisition and recording functions and can measure slow changing inputs such as temperature, to high speed (MHz) signals and sporadic one-shot events.

It has a 26.5cm TFT display with a wide viewing angle colour LCD that displays waveforms, setups and computed data. The scope has a wide range of waveform capture and analysis functions including an extensive choice of trigger functions and storage options, automatic computations of min/max values, RMS, frequency, risetime and other time axis parameters. FFT analysis functions are also supported. It also has a built in printer.

For further information circle 244 on the reader service coupon or contact Yokogawa Australia P/L, Private Mail Bag No. 24, PO Box North Ryde 2113.

Optoelectronics product catalog



A new 52-page catalog from the Optoelectronics Division of Californian-based Bivar Inc is now available. It covers LED displays, assembly and mounting products. It features complete specifications, including LED and assembly mounting styles and footprints, electro-optical characteristics, test criteria and a competitive product cross reference guide. It also has fax forms to order specific LED requirements by specifying the number of levels, voltages, lens type and other special characteristics.

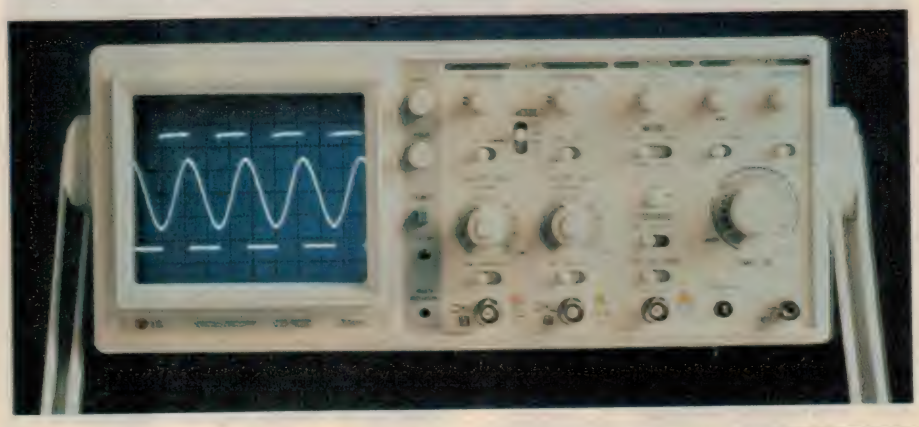
For further information circle 248 on the reader service coupon or contact M. Rutty & Co, 4 Beaumont Road, Mt Kuring-gai 2080; phone (02) 9457 2222.

20MHz analog scope

The new model 0S-9020 oscilloscope from LG incorporates SMT technology and weighs 7.5kg. This two-channel instrument has a bandwidth from DC to 20MHz, a maximum sensitivity of 1mV/division and a maximum sweep rate of 0.2us/division.

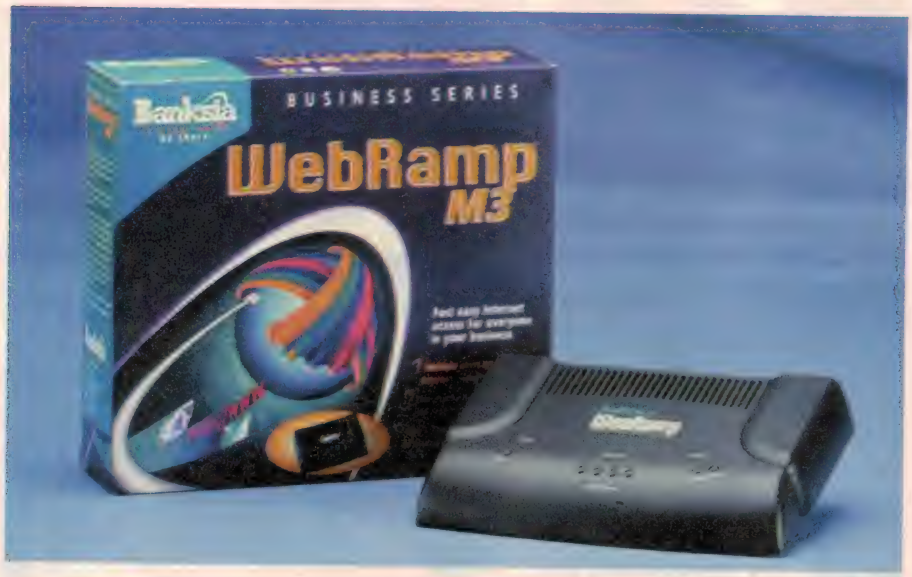
Channel 2 can be displayed in the inverted position and other display modes include channel addition, dual channel and chopped channel traces, and X-Y display. Triggering modes include TV vertical and horizontal sync (with separator circuit), auto and normal triggering. It has a clear 150mm rectangular screen with internal graticule.

For further information circle 247 on the reader service coupon or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066; phone (03) 9419 9999, freecall 1800 623 350. ❖



Modems and Data Communications Feature:

The Latest Products & Services



Internet access for multiple users

The WebRamp M3 from Banksia is designed to enhance Internet access for business. It allows multiple users to browse the Web by integrating a router, hub and up to three modems in one device. The system can also link together PCs that are scattered around an office, creating a network.

The M3 uses innovative built-in software to increase Web browsing speeds. A Web page is usually made up of different graphics elements and each modem can download a separate part of the page at the same time. So when three modems are used, the download speed is effectively tripled. With three 56kb/s modems, Banksia claims that ISDN-like speeds can be achieved. The router feature of the system then sends the data to the user's desktop.

The product is designed for non-technical users, doesn't require a knowledge of networking and is said to be easy to set up. Users on the office LAN do not need to wait until a modem or PC is free to access the Net as the WebRamp M3 allows simultaneous access.

For further information circle 201 on the reader service coupon or contact Banksia Technology P/L, 25 Sirius Road, Lane Cove 2066; Internet **http://www.banksia.com.au.**

Synchronous/asynchronous RS-232 fibre optic modem

The OSD136 synchronous/asynchronous RS-232 fibre optic modem is a small, self-contained modem that provides full duplex RS-232 communication for distances of up to 5km over commonly available multimode optical fibre. Its characteristics of handling clock, data signals and two handshake lines all operating at baud rates up to 20kb/s are derived from its single chip multiplexer. This IC also allows the modem to be used as a four channel multiplexer.

The modem can be set for asynchronous communications for data rates between DC and 20kb/s. In synchronous mode it is operated with an external clock. The modem is suitable for situations where distance, electrical noise or security considerations make conventional twisted pair links impractical.

For further information circle 202 on the reader service coupon or contact Optical Systems Design P/L, Unit 7, 1 Vuko Place, Warriewood 2102.

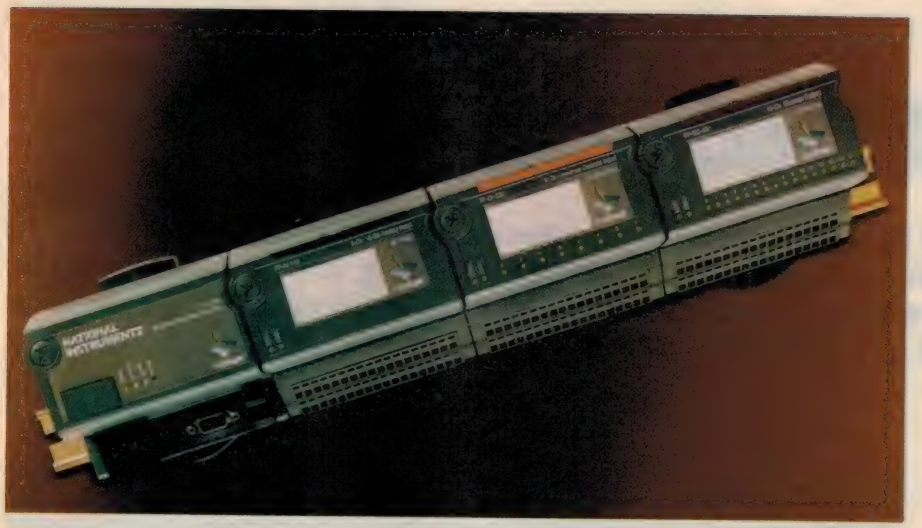
128kb/s ISDN modem

The Spirit Voyager from Mike Boorne Electronics is a high speed digital modem claimed to make functions such as Internet access, video conferencing, inter-office communications and large scale file transfers viable for even the smallest business. The modem is a second generation ISDN terminal adaptor which can replace most existing modems and deliver up to four times the highest present data throughput.

The basic ISDN service features two 64kb/s data channels which double as conventional telephone lines with individual phone numbers. The new modem can access both phone lines independently, with one for a fax or modem and the other as a normal phone line.

Alternatively, the two 64kb/s channels can be bonded to obtain 128kb/s Internet access or inter-office communications such as a local area network bridge.

The modem is claimed to be easy to install, and comes in a ready-to-run configuration with all necessary connectors, software and documentation. It has a comprehensive two year warranty and



technical support is provided for the lifetime of the product. The RRP is $799.

For further information circle 205 on the reader service coupon or contact Mike Boorne Electronics, PO Box 8, Turramurra 2074; Web site **www.spirit-modems.com.au**

Intelligent modular I/O system

National Instruments has announced FieldPoint, an intelligent, distributed, modular I/O system for monitoring and control applications. The system includes isolated analog and digital I/O modules, terminal base options, and network modules that can adapt the system to industrial networks. The initial network modules support RS-232 and RS-485.

Features include modular, snap-together packaging and DIN rail mounting; distributed intelligence for diagnostics and configuration; hot-swappable, plug and play operation; a facility to automatically store the entire configuration and output states of the system in nonvolatile memory for use on power-up; a high speed backplane bus to route local communication and power to each module, and 3kV RMS isolation. A full-function OPC (OLE for Process Control) server is available for Windows NT/95, providing connectivity to a wide range of industry software packages, including National Instruments' Bridgeview, Lookout, and Labview products.

For further information circle 206 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; Website at **http://www.natinst.com/.**

32-bit Ethernet LAN adaptor card

TDK (Australia) has released its newest Ethernet LAN adaptor PC card, the Network Flyer 100. It is claimed to be the first high speed Ethernet PC card that meets the new 32-bit high performance PC card standard, also known as CardBus. TDK developed the low power, low profile 100BaseTX chip used in the card and makes many of the SMT magnetic devices which are used in the card's design.

The card operates at 3.3 volts and is optimised for low power consumption. It also includes ODI and NDIS drivers, claimed to give faster connections to all the popular network operating systems. It is compatible with 10BaseT and 100BaseTX networks, and auto-senses and operates with either network. Tests indicate that the card operates eight times faster when using the 100BaseTX mode compared to the 10BaseT mode.

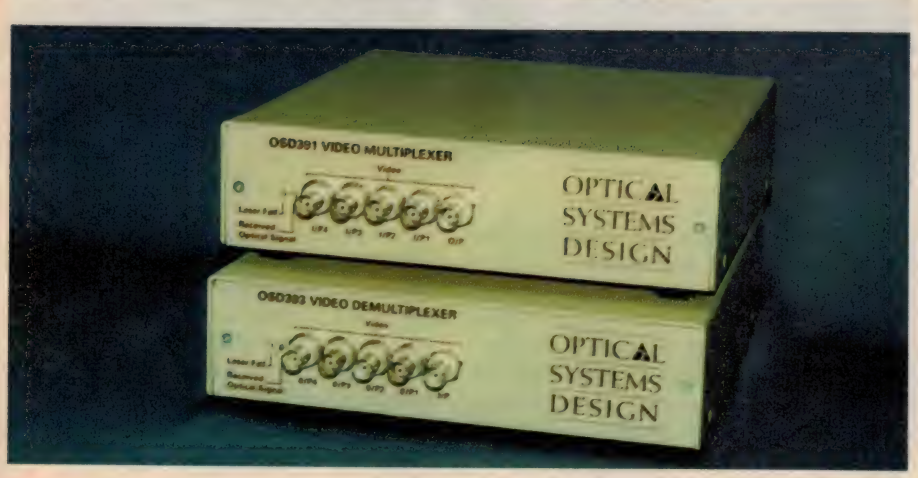
For further information circle 203 on the reader service coupon or contact TDK, 22 Lambs Road, Artarmon 2064; Internet **http://www.tdk.com.au.**

Four-channel AV or data multiplexer

The OSD391/393 from Optical Systems Design allows CCTV fibre optics transmission of two, three or four video signals and optional transmission of four audio and data channels, in one or both directions. There is also an optional reverse channel for video synchronisation.

It can operate over a range of up to 50km, although 100km is possible with optional 1550nm operation, and can operate on either single-mode or multi-mode fibre. A feature is the immunity to electrical interference. Applications include CCTV networks, video conferencing, transportation networks, industrial monitoring systems and distance learning.

For further information circle 207 on the reader service coupon or contact Optical Systems Design P/L, Unit 7, 1 Vuko Place, Warriewood 2102. ❖



56k modem review:

ZOOM'S FAXMODEM 56Kx

For the past 20 years US-based Zoom Telephonics has been designing and manufacturing communications equipment, and with the recent arrival of Zoom in Australia, these products are now appearing in local suppliers. The award winning Zoom 56Kx modem using 56Kflex technology has a lot of added features, and can even swing over to the competing x2 system if necessary.

by GRAHAM CATTLEY

If you are thinking of going out and buying a 56k modem, you'll probably have to make a rather important decision. There are two different, incompatible 56k standards out there at the moment: modems that use the 'x2' system, based on a TI chipset, and others that use the 'K56flex' system with a chipset produced by Rockwell and Lucent Technologies (formerly AT&T).

As was the case when the first 28.8k modems first appeared on the market, various companies tried to set the standard by coming up with their own format and hoping that it would catch on. In the case of 56k modems, the ITU international standard has yet to be ratified, and so it really is a two-horse race with x2 and 56Kflex each trying to come out in front.

Although the two standards *are* different and incompatible, there really is very little between them in terms of actual performance. What will probably matter most to you when buying a 56k modem is which of the two systems will be supported by your ISP, as this would probably be the deciding factor in which standard you go for.

At the time of writing, 56Kflex seems to be the leader, and so we thought that we'd take a look at what's probably the top 56Kflex modem around at the moment: Zoom telephonics' 56Kx faxmodem. We decided to try out their external model, known officially as the model 2849-PC(E) faxmodem, but they also produce an internal version as well.

The Zoom 56Kx 56kb/s modem. It supports the K56flex system, but uses a flash ROM DSP unit that can be re-programmed to use the alternative 'x2' system if needed, when the 56k standard is agreed on.

Extra LEDs

The Zoom 56Kx measures 35 x 130 x 165mm (a little taller than most), with an angled front panel displaying 14 LEDs. These show all the usual TD, RD, CD, OH and similar status indications, as well as a couple of extras, including separate indication of V.42 and V.42*bis*. There's also a V.34 (33.6kb/s) LED, and another that lets you know when you are actually receiving data at 56k.

It turned out that the modem that Zoom sent to us for review was the American model, which didn't include a serial cable and needed an Australian plugpack. But Zoom confirmed that the Australian model will contain both of these (rather necessary) components, along with a host of bundled voice, fax and coms software in both 16- and 32-bit versions.

It will also be configured to recognise Australian dial tones, busy signals and other parameters of the Australian telephone system, unlike the American model we tried which needed configuring before it could be used on Australian lines.

One big plus with the Zoom 56Kx is that it contains a flash programmable

controller and DSP unit. This will allow the user to upgrade the modem's firmware to the ITU standard, when it is eventually settled.

The standard is likely to come out in late 1998, and the idea is that Zoom will then be able to provide software that can be run on the PC to perform the upgrade on the modem. The only problem with this system is that nobody knows if full compliance with the standard can be achieved with such a firmware upgrade; if a hardware modification is needed (such as a revised chipset) then the modem will obviously need to be returned to the manufacturer, with the upgrade performed there.

It's interesting to note that even if the standard ends up being in favor of x2, the Zoom 56Kx can be completely re-programmed to use x2 instead of its original 56Kflex system. This shows the flexibility of a flash ROM system, as there is (theoretically) no reason why it will be superseded by 'next year's model'.

Arcs & sparks

One of the main selling features of the Zoom 56Kx is its protection against power spikes on the phone line. These spikes can be caused by nearby lightning strikes, and are said to be the leading cause of modem failures. Here at EA we've had one modem fail during a storm, and so were quite interested in this feature, as the protection (called 'ZoomGuard') is supposed to be better than the standard 'varistor' system normally used.

In tests carried out by the Communication Certification Laboratory (CCL) in the US, the Zoom 56Kx modem was subjected to power surges typical of those caused by lightning strikes, with jolts of 800V, current limited to 100A. This testing complies with part 68 of the US FCC regulations, and apparently the Zoom 56Kx survived without any problems. Other modems (from major manufacturers) suffered in various ways, including failure to hang up, and thus tying up the line.

Another feature is the inactivity timer, a programmable 'watchdog' that monitors the data flow and takes the modem off line if the no data has been transfered for a period ranging from 1 to 42 minutes.

It is also supports Caller ID (where implemented), and is compatible with Telstra's Faxstream and DUET systems.

Will I get 56k?

As you may already know, high quality phone lines are needed between you and the local exchange if you are to have any chance of receiving data at 56kb/s. Your ISP will also need to have a direct digital link to their exchange, but most of the larger ISPs have had this digital connection for some time now.

According to Zoom, if you are regularly getting 21.6kb/s on a V.34 modem, then you will probably be able to achieve a 56kb/s download rate with the Zoom 56Kx.

One fairly important point that I wasn't aware of until recently, is that if you are using a standard 16550 UART with a 56k external modem (or even internal models, as these contain their own UART), you can only achieve a maximum bit rate into the computer of 115.2kb/s. This sounds fine, until you factor in the data compression (or rather decompression) performed by the modem. If the compression ratio is greater than 2:1, then the bit rate is limited by the serial port, not the modem.

The end result of all this is that although 56k modems have the potential to download at speeds double that of a 28k modem, it is quite possible that you won't actually achieve this speed in practice. However, if you are in the market for a new modem, you might as well go for a 56k job, and by all accounts the Zoom 56Kx has a lot going for it. Lightning protection, extra indicator LEDs and a flash re-programmable DSP, together with a five year warranty from Zoom would seem to make this modem the best in its class. ❖

Zoom 56Kx

A 56k faxmodem, based on the 56Kflex protocol. Comes with inbuilt surge protection and is available in both internal and external models.

Good points: Able be re-programmed to comply with the 56k standard (when it's made official), even if this involves changing over to the x2 system. Additional informative status LEDs.

Bad points: Case was a bit clacky, and the PC board rattled around inside, giving it an undeserved cheap feel.

RRP: $249 for the external model, and $229 for the internal version.

Available: Most leading computer stores, or contact Zoom Telephonics (Aust) on 1300 300 842, Fax (07) 3257 3669.

Their address is 19 Campbell Street, Bowen Hills, Qld 4006.

Computer News and New Products

Easy to use CD-RW drive

Hewlett-Packard has announced what it claims as the industry's first full-functional CD-rewritable (CD-RW) drive that is as simple to use as a conventional floppy disk drive.

The HP SureStore CD-Writer Plus drive has up to 650MB of rewritable, removable capacity, and is compatible with DVD-ROM, CD-R and CD-ROM compact discs. It is said to be the first drive that takes full advantage of the compact disc universal device format (CD-UDF) specifications file-by-file rewrite capability. Applications include storing, transporting and archiving large files, or as an extension of the system's hard-drive for temporary storage of Internet information or data-intensive files.

Two versions are available, the internal 7100i and the external 7100e, both with a one year exchange warranty. The 7100e has an estimated street price, including tax, of $975, and the 7100i will cost around $795.

For further information phone the HP Customer Information Centre on 131347 or visit the HP Web site at **http://www.hp.com**.

14" TFT monitor

Samsung Electronics has announced the worldwide launch of the SyncMaster 400TFT, a 14" flat panel PC monitor that uses a TFT-LCD screen. The monitor weighs 3.6kg, is 6cm thick and is said to generate virtually no electromagnetic waves.

The display comes with a multisync processor, produces 260,000 colours and can operate with a resolution of 1024 x 768 (XGA), as well as VGA (640 x 480) or SVGA (800 x 600). This allows it to be used under the same conditions as a conventional CRT monitor.

The display produces 200 candelas per square metre, claimed to be 25% brighter than a CRT monitor, and takes 30 watts when operating — 57% less than a typical 15" CRT monitor. It features an on-screen display that facilitates function control, and comes with built-in stereo sound and microphone, to suit a multimedia environment.

For further information circle 160 on the reader service coupon or contact Samsung Electronics, Unit G, 10-16 South Street, Rydalmere 2116.

32-channel relay output board

Intelligent Systems Australia has released the PI-932, a 32-channel relay output board. The card accepts a 37-pin D-type connector and 32 single-pole dual-throw (SPDT) relays. The high-power relay handles up to 250V DC at 3A and has a LED on/off status indication for each relay.

An external 24V DC 2.5A power source is needed to drive the relays, and the card has industrial screw terminals for ease of wiring. It has a life expectancy up to 100,000 cycles at rated load and is easily interfaced to a standard TTL level output card. The card operates from the computer's internal 5V DC power supply, and takes 1A (max).

For further information circle 165 on the reader service coupon or contact Intelligent Systems Australia, PO Box 118, Berwick 3806; phone (03) 9796 2290. Internet site at **http://www. intelsys.com.au.**

New, faster Bubble Jet printer

Canon has announced the BJC-210 SP, a new photo-quality mode Bubble Jet printer that features a 'super economy' mode to reduce operating costs. It incorporates a new high-capacity ink cartridge, the BC03, which has 20% more useable ink and prints up to 2400 pages in black and white. The BC05 colour cartridge can print up to 600 pages in colour.

The printer produces photo-quality printing through a three-colour ink system that works with an advanced printer driver, claimed to outperform more expensive four-colour systems in its category. It's said to have improved half tones, reduced colour bleeding and to give sharper definition by producing a richer black in which 100% cyan, magenta and yellow are placed directly on top of each other. The printer driver also helps maximise the use of colour by selecting highlights and shadows in an image and emphasising them through better contrast.

The printer has a 64-nozzle print head and a speed up to 248cps, giving up to 4.5 pages per minute (ppm), claimed to be five times faster than comparable printers. It has an RRP of $269 and a one year warranty.

For further information circle 163 on the reader service card, see your nearest Canon dealer or contact Canon Australia P/L, 1 Thomas Holt Drive, North Ryde 2113.

Double speed DVD-ROM

Hitachi Australia has announced the Australian release of the company's second generation DVD-ROM drive, which features x2 normal speed operation. Hitachi has also announced that local company Verbatim Australia has incorporated the DVD-ROM drive into a complete multimedia kit suitable for PC applications or TV playback. Called the Verbatim Activemedia DVD-ROM upgrade kit, it has an RRP of $1199 including tax.

The Hitachi GD-2000 DVD-ROM features an extended storage capacity of 4.7 gigabytes per side for a total capacity of 8.5GB, using a two-layer disc. This capacity provides seven times the capacity of current CD-ROM drives, giving enough space to store a 135 minute MPEG-2 encoded film or video.

The drive has a DVD transfer rate of 2.76MB/s, said to be twice the rate of other DVD drives. It is compatible with CD-ROM based material, operating at up to 20 times maximum speed, or 3.34MB/s in constant angular velocity (CAV) mode. It is also compatible with the new CD-RW (erasable) and older CD-R formats.

For further information circle 161 on the reader service coupon or contact Hitachi Australia Ltd, 13-15 Lyonpark Road, North Ryde 2113.

PC family has fast graphics

Hewlett-Packard has announced the HP Kayak PC workstation family, a new generation of high-performance Windows NT-based PC workstations designed around Intel's Pentium II processor.

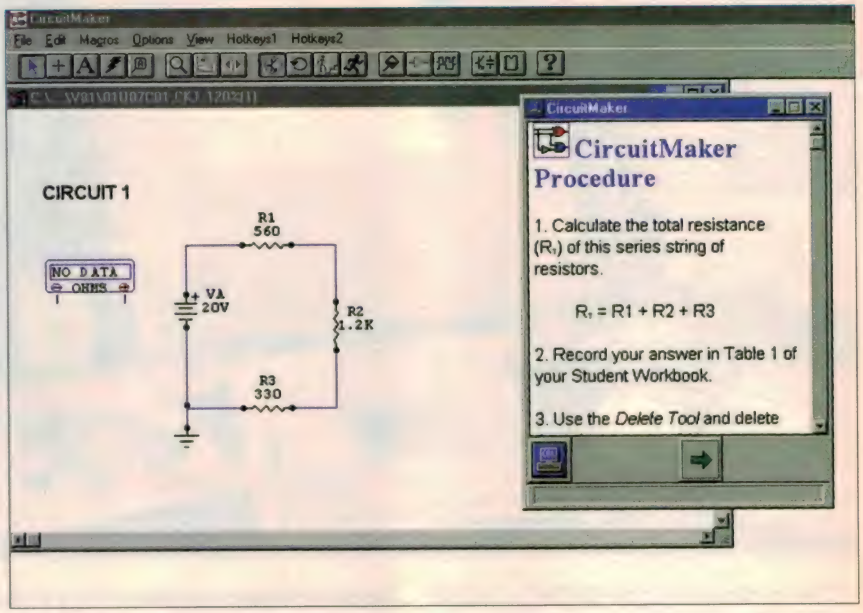
The new HP Kayak family has a system architecture built on the new Pentium II 440LX AGPset, claimed to give the fastest graphics currently available on the Intel platform. It also has a proprietary SCSI subsystem said to improve system performance by up to 80% during disk-intensive operations, an intelligent cooling system that maintains critical system components within their specified operating temperatures, 10/100Base-T network connectivity and HP Fastboot BIOS for reduced boot time. It features a single Intel 233MHz, 266MHz or 300MHz Pentium II processor, 440LX AGP-based system architecture and Cirrus Logic's CL-GD5465 64-bit AGP graphics accelerator.

For further information phone the HP Customer Information Centre on 131347 or visit the HP Web site at **http://www.hp.com**.

Educational software for electronics

A collaboration between Lab-Volt and Microcode Engineering has resulted in the release of a computer based training (CBT) version of Circuitmaker, a circuit design and analysis program. The CBT version is a stand-alone core electronics curriculum covering AC and DC theory as well as analog and digital concepts. It is delivered in a Windows format designed for the Lab-Volt F.A.C.E.T. hardware-based electronics program, and uses Circuitmaker as the testing and simulation platform. This allows the user to run and manage the CBT program in much the same way as a traditional Lab-Volt F.A.C.E.T. laboratory.

For further information circle 164 on the reader service coupon or contact Lab-Volt, PO Box 289, Ingleburn 2565; phone (02) 9605 2455, Web site **www.ozemail.com.au/~ttsvolt**



Memory emulators with debugger support

Scanlon Design's new E-series memory emulators can emulate EPROM, FLASH and static RAM memory devices from 8K x 8 to 128K x 8 (E1), to 8K x 8 to 1024K x 8 (E8). Features include live editing, live watches and advanced debugging facilities such as memory mapped bi-directional communication and third party remote debugger support that allows the target system to pass debugging information back to the host PC.

The emulators also allow error checking and correction while downloading (420kb/s). They have a 70ns access time and draw a maximum current of 5mA (1mA typical). Each emulator comes with 28 and 32-pin DIP adaptors, and 32-pin PLCC adaptors are available. Low voltage versions that operate from 2.7V and 5.5V are also available. The emulators retail from $199 US (El-70) to $369 US (E8LV-90).

For further information circle 162 on the reader service coupon or contact Scanlon Design Inc, 5224 Blowers Street, Halifax, Nova Scotia, Canada, B3J 1J7. (Internet **www.scanlondesign.com**) ❖

WEBWATCH

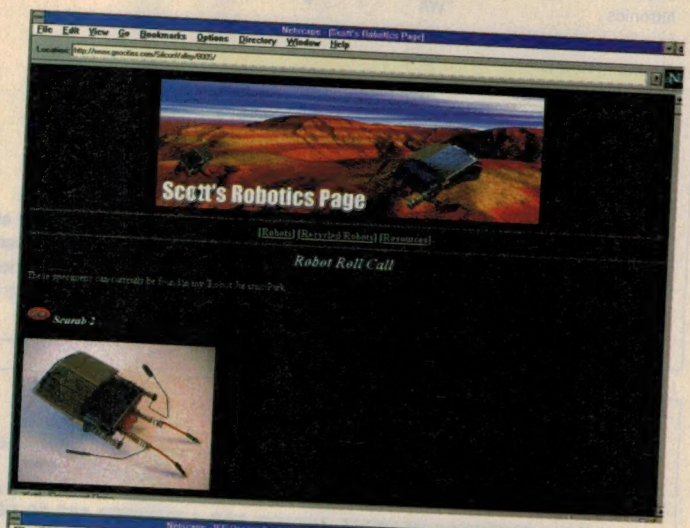
presented by GRAHAM CATTLEY

Beam Robotics

http://www.geocities.com/SiliconValley/8005/

EA reader Andrew Vaughan put us onto the subject of BEAM robotics, and after a little hunting around I came across this site. BEAM stands for Biology, Electronics, Aesthetics and Mechanics. Most BEAM robots are built from bits of old cassette mechanisms, miniature electric motors, springs and wire, and are powered by a mixture of batteries, solar cells and large capacitors. There are many sites devoted to the subject, and Scott Andress' Robotics Page is a good starting place if you are interested, as it contains many high quality images of the many BEAM robots he's built as well as details on how to make your own.

There's links to a variety of BEAM robotics resources, including the BEAM Robots FAQ, the BEAM Resource (which includes BEAM subscription information and archived material), as well as links to a number of companies supplying BEAM kits. You can also get onto the 'BEAM ring' — a system whereby you can visit all the BEAM sites in turn without having to search for them all individually.



EE Design Center

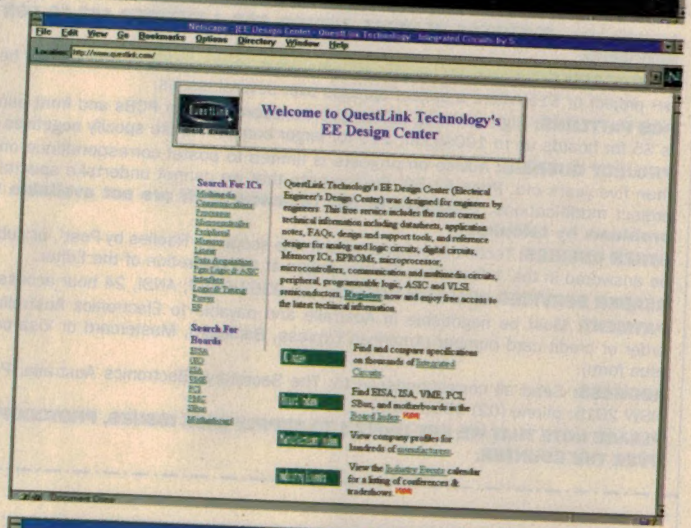
http://www.questlink.com/

If you liked the Chip Directory presented in the September issue, you'll love this site suggested by *EA* reader Graham Pratt.

The EE Design Center claims the world's largest and most complete index of integrated circuits, semiconductors, components, board products and EDA tools. You can get information on over 350,000 ICs, and download datasheets, application notes, reference designs and FAQs as well.

Of course there are links to almost every semiconductor manufacturer you can think of, and this site also gives you the chance to catch up on the latest industry news as well.

You'll have to register to get full access to the site, but this is relatively painless, and doesn't cost anything — which is surprising considering the amount of useful data available.



Philips Passive Components

http:/www.passives.comp.philips.com/

OK, so you've seen lots of sites that cover semiconductors — how about one that covers passive components instead?

Philips have recently released their passive component site that lists details of more than 100,000 different passive components. The range includes capacitors, fixed resistors, potentiometers, thermistors, varistors, quartz crystals and oscillators. (Inductors are conspicuous by their absence, though.)

Data sheets for most of the range can be downloaded in PDF format, as can photos of products and ordering information. The site provides a fairly comprehensive search facility, that will scan through all 6000 or so pages in the site and seems to work quite well.

For some reason you have to select the area in the world you are calling from when you first log on, and you are then directed off to the appropriate section of the site. What difference this makes to the data available to you isn't clear though. ❖

Come across any good sites that you think other EA readers would be interested in? If so, feel free to let us know — our email address is **electaus@magna.com.au.**

EA DIRECTORY OF SUPPLIERS

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also, some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
Altronics	WA	•	•	•	•	•	•	•
Dick Smith Electronics	ALL	•	•	•	•	•	•	•
Emona Instruments	NSW						•	
Jaycar Electronics	Eastern	•	•	•	•	•	•	•
Oatley Electronics	Eastern	•			•	•		
RCS Radio	NSW			•				
Rod Irving Electronics	Eastern	•	•	•	•	•	•	•
Scientific Devices	VIC						•	

KEY TO CODING

A	Kits and modules	D	Components
B	Tools	E	IC chips and semiconductors
C	PC boards and supplies	F	Test and measuring instruments
		G	Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Company, P.O. Box 199, Alexandria 2015; phone (02) 9353 9992.

BACK ISSUES: Available only until stocks are exhausted. Price A$7.50 which includes postage within Australia only. **OVERSEAS READERS SHOULD ADD A FURTHER A$2.50 FOR EVERY BACK ISSUE REQUIRED.**

PHOTOCOPIES: When back issues are exhausted, photocopies of articles can be supplied. Price $7.50 per project or $15 where a project spreads over several issues.

PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications. **Members of our technical staff are not available to discuss technical problems by telephone.**

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

READER SERVICES BULLETIN BOARD: (02) 9353 0627; ANSI, 24 hour access; any rate to 28.8kb/s.

PAYMENT: Must be negotiable in Australia and payable to Electronics Australia. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).

ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria NSW 2015; phone (02) 9353 0620.

PLEASE NOTE THAT WE ARE UNABLE TO SUPPLY BACK ISSUES, PHOTOCOPIES OR PCB ARTWORK OVER THE COUNTER.

Name:.....

Address:.....

.....State:.....Postcode:.....

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Back issues:.....

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Photocopies:.....

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Amount: A$.....

Signature:.....(Unsigned orders cannot be accepted.)

Method of Payment: (Please circle correct method.) Credit card / Cheque / Money order.

Credit cards accepted:

Mastercard, American Express, Visa Bankcard (please circle applicable card).

Expiry date:.....

....

ADVERTISING INDEX

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

BARGAIN CORNER

See our Web site for more bargains like these:

- **car communications speaker** in box with swivel mount 4Ω, 3W, 1.5m cable terminated in jack plug: **$6**
- **mystery box PCB**, probably from phone hands free unit, has two power MOSFETs (IRF9530 and IRF530), inductors, connectors + surface mount components: **2 for $4**

NEW UHF LEARNING REMOTE CONTROL

First time ever! A small ready-made keychain transmitter that can learn up to 4 channels from almost any (not code hopping) UHF remote control in the range of 280-460MHz. No track cutting or DIP switches. Has tuning indicator LED: **$39**

12V DC LIGHTING

Very efficient, properly driven fluorescent white light source! Includes an inverter kit that can drive up to three 11W compact fluorescent lamps (CFLs). Inverter plus one 11W CFL: **$35**. extra CFLs (max of 3) **$11 ea**.

MAGNIFIERS

See SC May 96, small jewellers eyepiece: **$3**, 50mm twin lens loupe: **$8**, 75mm: **$12**, 110mm loupe: **$15**. ***SPECIAL*** Set of all four: **$25**

MIDI KEYBOARD SPECIAL

See EA. Feb 97, quality MIDI keyboard with 49 keys, 2-digit LED display, MIDI out jack, many functions including wheel, transpose. Size: 655 x 115 x 35mm. Computer software included: **$70** 9V DC plugpack: **$12**

NEW SEMICONDUCTORS

- 2SK2175 — MOSFETs 15A, TO220, 60V, 30W: **10 for $15**
- CA3140 — MOSFET I/P opamp: **5 for $5**
- TL494 — switchmode power supply IC: **5 for $5**
- NE555 — timer IC: **10 for $5**
- ICL7106 — LCD display driver: **$5**
- ICL7107 — LED display driver: **$5**
- IRFZ44 MOSFETS: 60V, 0.028 ohm on-resistance, 50A: **10 for $3**
- C8050 & C8550 transistor **20 for $5**
- CMOS ICs 4001. 11, 13, 16, 17, 20, 24, 28, 40, 46, 60, 66, 69, 93: Any mixture: **10 for $8**

SUPER BRIGHT BLUE LEDS

BY FAR THE BRIGHTEST BLUE EVER OFFERED, super bright at 400mCd: **$1.50** ea or **10 for $10**

5mm LEDS AT SUPER PRICES

- 1Cd red: **10 for $4**
- 300mCd green: **$1.10** ea. or **10 for $7** (*make white light by mixing the output of red green and blue*)
- 3Cd red: **$1.10** ea. or **10 for $7**
- 3Cd yellow (small torch!) also available in 3mm: **10 for $9**
- Super bright flashing LEDs: **$1.50** ea. or **10 for $10**

NEW COMPUTER CONTROLLED STEPPER MOTOR KIT

Similar to our previous stepper motor kit but with improvements so larger motors can be driven more efficiently, with much reduced loading on the computer's parallel port, and 2.5KV opto-isolation between the stepper driving circuit and the computer. PCB and all on board components kit plus software and information: **$39** or with two M35 motors: **$49**

STEPPER MOTOR DRIVER KIT

Kit includes a large used 1.8º. (200 step/rev) motor and used SAA1042A IC with a variable frequency clock generator, so can be clocked internally or externally. Logic levels determine CW or CCW rotation, half or full step operation, enable/disable, clock speed: **$18** for single motor driver kit with 1 motor, **$28** for twin motor driver kit with 2 motors

CCD IMAGE SENSOR

High quality "Thomson" brand, 576x550 pixels with antiblooming, with full data but no circuit suggestions, usable response from 400 to 1100nm, 30dB S/N at 40 milli-lux, 2/3" optics compatible format: **$35**

COLOUR MONITOR

New 12V DC-1A 6" colour monitor, no case, just the tube and driver PCBs, RGB inputs (some info might be available): **$65**

VERY EFFICIENT WHITE LIGHT - LCD DISPLAY

Brand new "second grade" (few missing pixels) Sharp 640x480 LCD display (LM64P722) with a very efficient "state of the art" cold cathode BL fluorescent lamp (5mm dia, 150mm long) which is very easy to remove! Produces useful white light at about 1-3W AC input! Lamp has a 10,000hr life! Removing the display reveals a uniformly lit 150 x 200mm backplane. Complete display plus BL inverter kit (needs 12V/150mA): **$17** Data sheets (11 pages) for a similar display: **$2**

CALLER ID

See the phone number of your incoming calls on an LCD screen while the phone is ringing. Has 80 call memory, dialler etc. Approved units available soon. Around **$50**!

BEST VALUE CCD CAMERA

The best "value for money" CCD camera on the market! Tiny CCD camera, 0.1 lux, IR responsive, high resolution. This camera has a metal lens housing (not plastic) and performs better than many cheaper models. Choose from these lenses: pinhole (60º), 78º, 92º **$105**, or 120º for **$120**.

KITS FOR CCD CAMERA SECURITY

New INTERFACE KIT FOR TIME LAPSE RECORDING: now has relay contact outputs! Can be directly connected to a VCR or via a learning remote control: **$25** for PCB and all on-board components, used PIR to suit: **$12**.

- **32mm 10 LED IR ILLUMINATOR** new IR (880nm) LEDs have an output about equal to our old 42 LED IR illuminator: **$14.**
- **32mm AUDIO PREAMPLIFIER** An **$8** kit that produces a 'line level' signal from an electret microphone, connect the output to our:
- **UHF VIDEO TRANSMITTER ($30)** or **$20** when bought with the camera. for a complete Audio-Video link.

32mm AUDIO AMPLIFIER: An LM380 based **$9** audio power amplifier which can directly drive a speaker — needs the 32mm preamplifier. *WHAT IS 32mm?* All boards are 32mm dia, so you can house these kits in a plastic 32mm joiner: cheap plumbing part.

AUDIO - VIDEO MONITOR

2ch compact high res 5" screen B/W audio and video monitor. 12V DC 1A. Monitor and 6-way mini input connector only: **$125**

AMPLIFIER - PREAMP AND MORE

A high quality mostly SMD PCB with a 5W amplifier based on a TDA1905 IC, and a separate audio preamp. Includes a high quality unidirectional electret mic with wind filter and mounting clip, small speaker and hook up info. Has many uses, such as a 2-way intercom that doesn't require switching (needs 2). Less than the cost of the mic! **$15 ea, 2 for $24**

BOSSMAN ELECTRONICS

A new subsidiary company to OATLEY ELECTRONICS, for giving TAX EXEMPT PRICES to entitled organisations. Product range will increase rapidly.

Phone (02) 9584 3562
Fax (02) 9584 1031

LASER ENGINE

New complete laser engine as used in laser printers. Includes a polygon scanner motor with xtal controlled driver PCB, 5mW/780nm laser diode in collimated housing mirrors/mirrors lenses, and info to make motor & laser operational. Bargain **$35**

SOLAR REGULATOR

Ref: EA Nov/Dec 94 (intelligent battery charger). Efficiently charge 12-24V batteries from solar panels, but can also be used with simple car battery chargers to prevent overcharging. Very high efficiency due to MOSFET switch and Shottky diode. 7.5A or 15A kit: **$26/$29** (K09)

MASTHEAD AMPLIFIER KIT

Our famous MAR-6 based masthead amplifier. 2-section PCB (so power supply section can be indoors) and components kit (K03) **$15.** Suitable plugpack (PP2): **$6** Weatherproof box: (HB4) **$2.50**. Box for power supply: (HB1) **$2.50** Rabbit-ears antenna (RF2) **$7** (MAR-6 available separately)

PC POCKET SAMPLER KIT

Data logger/sampler, computer controlled chart recorder, slow speed scope. Incredible value value **$30**

650nm LASER POINTER SPECIAL

Light weight 2 x AAA pen-size pointer with 650nm laser, very bright: **$55**

650nm LASER MODULE

Our new module has a 650nm laser diode. 35mm dia, very bright! **$50**

VISIBLE LASER DIODE MODULE KIT

Same circuit as our "visible laser diode kit" but a smaller PCB (25 x 50mm, WxD) that fits into tubing. 650nm/5mW laser diode, 3V: **$29**

AUTOMATIC LASER LIGHT SHOW

Three motors, mirrors, PCB and component kit. Produces a huge range of amazing patterns: (K83) **$77**. Or, with the above kit: **$90!!**

5mW/650nm LASER POINTER KIT

YES, NEW 650nm kit. Very bright! Complete laser pointer that works from 3–4V DC. Includes 650nm/5mW laser diode, new handheld case 125x39x25mm, adjustable collimator lens, PCB battery holder: (K35) **$30**

DISCO LASER LIGHT SHOW PACK

The above 5mW/650nm kit plus our AUTOMATIC LASER LIGHT SHOW: **$99**

ADVERTISING

We now advertise in Silicon Chip and Electronics Australia on alternate months. When we aren't in EA, look in SC, and vice versa.

DIGITAL BAR CODE WANDS

New, US made wands with 2.5m curly cord terminated in a 5-pin 240º DIN plug. Has optical sensor, visible red LED, photo IC detector and precision aspheric optics. Gives a digital output when manually swept across a bar code. Has sapphire tip, pot size 0.19mm. Open collector TTL/CMOS compatible output, 5V supply: **$45**

NICAD CHARGER & DISCHARGER

Professional, SMD, switch mode, assembled and tested NICAD battery charger/discharger PCB assembly. For fast-charging 7.2V AA nicads. Basic info provided, plugpack not included. *Bargain:* **$9** ea or **3 for $21**

NICAD BATTERY SPECIAL

New 1.2V-400mAh cells wired in packs of 6. Each pack has a thermal cut out switch, each cell is 16 x 45 x 5mm, as used in mobile phones, 6 packs (30 batteries): **$10**

DC MOTOR SPEED CONTROL-EXPERIMENTERS PACK

20A motor speed controller kit (similar to SC - Jun 97) **$18,** plus two small new 12V DC motors (40mm dia, 40mm long) plus one used car windscreen wiper motor (has internal gear reduction): **$32**

COMPUTER POWER SUPPLY

New, complete PCB assembly only. Size 45 x 108 x 200mm. Switchable 120/230V AC input. DC outputs: +5V/6A, +12V/1A, -12V/1A, -5V/1A. Circuit provided, RU approval. Modern design. Mains input - not for the inexperienced! Be quick: **$16 ea** or **4 for $56**

12V/7Ah GEL BATTERY BARGAIN

Fresh stock 7Ah battery (150 x 95 x 65mm, 2.7kg) and one gel/lead-acid battery charger: **$30**

HELIUM NEON LASER BARGAIN

Large 2-3mW He-Ne laser head plus a compact potted US made laser power supply. The head plugs into the supply, and two wires are connected to 240V mains. Needs 3-6V/5mA DC to enable. Bargain: **$100.** 5mW tube and 12V inverter kit: **$80**

MORE KITS

- Geiger counter: **$40**
- Breath tester: **$40**
- 12V DC inverter for compact fluoro lamp + one CFL lamp: **$35**
- Music box: **$11**
- Ding dong doorbell: **$3.50**
- Siren using a 10cm speaker: **$14**
- Electric fence + used car coil: **$25**

WOOFER STOPPER Mk II

Works on dogs and most animals, PCB and all on-board components, transformer, electret mic & horn piezo tweeter ON SPECIAL: **$33**, extra tweeters (drives 4): **$7** ea Approved 13.8V 1A plugpack **$10**

OATLEY ELECTRONICS

PO Box 89, Oatley NSW 2223
Phone (02) 9584 3563
Fax (02) 9584 3561
orders by e-mail: oatley@world.net
WEB SITE: http://www.ozemail.com.au/~oatley
major cards with phone and fax orders, P&P typically $6.

Where do you go to spoil yourself for Christmas?

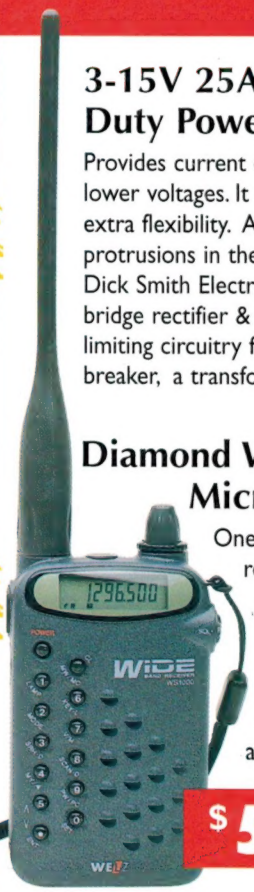
Dick Smith Electronics is the place to go for all your Christmas needs. Visit us today and our friendly, expert staff will show you a great range of products for your workshop or radio shack.

3-15V 25A Heavy Duty Power Supply

Provides current of up to 25A ICAS at 15V, 20A continuous at 13.8V and lower current at lower voltages. It also has high current banana-style and low-current output connections for extra flexibility. An internal heatsink and thermally-switched fan provides cooling without protrusions in the metal case (which measures 320 x 150 x 145mm). Specially modified for Dick Smith Electronics to provide more reliable long-term operation, it uses a rugged 50A bridge rectifier & trifilar transformer plus extensive overload protection through dissipation limiting circuitry for the pass transistors, a 30 Amp instantaneous current limit, AC mains circuit breaker, a transformer thermal fuse & fused auxiliary secondary winding. D 3800

$299

Diamond WS1000E Micro Scanner



One of the world's smallest scanning receivers, it will easily fit into your hand or shirt pocket. Operating on 2 x 'AA' batteries it provides a huge 500kHz to 1300MHz coverage with 400 memory channels, speedy search and scan operation, plus menu settings for more advanced users. D 2792

$595

Uniden 760 XLT Scanner

Versatile home/mobile scanner with 100 memories and 5 programmable search banks. Covers 66-88, 118-174, 406-512 and 806-956 MHz bands. Includes mounting bracket, DC power lead and AC adaptor. D 2760

uniden. **$299**

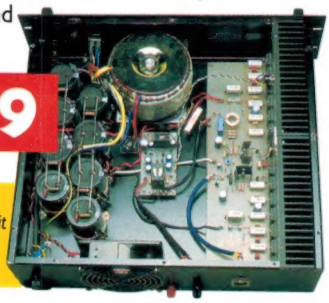
Monster 500W Mono Block Power Amplifier

• Ideal for musical instruments and PA work. Use 2 for a stereo set-up • Output: 500W RMS @ 4 ohms (278W @ 8 ohms) • Music Power: 590W into 4 ohms (315W into 8 ohms) • Frequency Response: +/-0.3dB @ 20Hz & 20kHz • Input sensitivity: 1.43V RMS (for full power into 8 ohms) • Harmonic distortion: typically less than .01% • Signal-to-noise ratio: 117dB unweighted (20Hz - 20kHz); 122dB A-weighted • Thermal cut-out • Overload protection • DC offset adjustment • Fan cooled • Power source required: 240 volts AC • Supplied with all components, PCBs & hardware, drilled and tapped heatsinks, 120mm cooling fan, large 10,000uF 100V filter capacitors, toroidal transformer, pre-punched powder-coated case and deluxe front panel

K 5582

SILICON CHIP Aug/Sept/Oct '97

Delivered to your DOOR!



$799

direct link *Due to the size, weight and split packaging of this kit, it is only available by mail order. We will deliver the complete kit direct to you at no extra charge! (delivery Australia only)*

PHONE 1300 366 644 to reserve your order

Build A Solar Aeroplane!

Solar 4-in-1 Construction Kit

This plastic construction kit can make loads of different designs such as an aeroplane, helicopter etc. It includes a small solar motor that can be connected to your built-up designs to make them move. O 2033

$19.95

DICK SMITH ELECTRONICS *That's where you go*

For further information, orders or the location of your nearest store call:

1300 366 644 (Local Call Charge)

Or Fax: (02) 9395 1155

B 3168